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MARY CYNTHIA DICKERSON, *Editor*

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A MOLTING ROCK HOPPER

In the latter part of January the penguins in the Falklands begin shedding their feathers and remain on shore until the new feathers have replaced the old. The unkempt, ragged looking specimen above is shedding his old suit in patches, and bears little resemblance to the clean, trim figure he will present two weeks later. Soon after the birds have finished molting and the young have their feathers fully grown, the rock hopper penguins go to sea, and the greater number do not return until the following spring, which begins, in the latitude of the Falklands, about October. Some of them travel hundreds of miles from the place where they were hatched, and how they find their way back is still a mystery.

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Bird Photographing on the Falkland Islands¹

By ROLLO H. BECK

Illustrations from photographs by the Author

INTRODUCTORY NOTE.—The birds of the order Tubinares, or tube-nosed swimmers, comprising the albatrosses, fulmars, shearwaters and petrels, pass their lives at sea, usually some distance from land, except when they visit the land to nest. They are, therefore, preëminently pelagic. Certain species may abound off our coast, but, unless blown ashore by a severe storm, or attracted to the littoral by the exceptional abundance of food, we may be unaware of their existence. While distributed over the oceans of the globe, the Tubinares are more abundant in the southern Pacific, to which region many species are restricted. Here they breed on islands often so remote and inaccessible that the nesting places of numbers of species are as yet unknown.

The facts thus briefly stated render it obvious that in order to secure specimens of Tubinares one must cruise in distant and tempestuous waters and encounter hardships, dangers, and difficulties such as do not confront the collector of land-inhabiting birds. Here, in a few words, we have the reasons why these birds, which exist in incalculable numbers, are still, generally speaking, so rare in collections.

It was this same rarity, in connection with our accompanying ignorance of the habits of these winged wanderers of the high seas, that influenced Dr. L. C. Sanford and Mr. Frederick F. Brewster to make an especial effort to fill this gap in ornithological collections, as well as in ornithological biography. To this end they fortunately obtained the coöperation of Mr. Rollo H. Beck. Mr. Beck not only has an extended experience in collecting Tubinares, chiefly in the northern Pacific, but he has established a record for marine bird collecting which has placed him in a class by himself as the most successful worker in this branch of ornithology that the world has ever known.

In December, 1912, Mr. Beck was dispatched by Messrs. Sanford and Brewster to the west coast of South America. He began his researches off the coast of Peru, engaging coasting vessels, small boats, or steamers to take him far enough from shore to find the birds which were the especial objects of his expedition. During the succeeding five years he extended his explorations southward, visiting the Juan Fernandez Islands, passing a year in the Cape Horn region, going to the Falkland Islands, and stopping at various points on the Atlantic coast of South America. He also visited certain West Indian islands and in Santo Domingo, Haiti and Cuba ascended to the summits of mountains before unsealed by a naturalist.

To present, even in barest outline, a record of Mr. Beck's discoveries and additions to our collections of birds as well as to our knowledge of their distribution and habits, would require a volume. Here it need be said only that as a result of his labors the Brewster-Sanford collection now contains a larger and better representation of the Tubinares inhabiting the regions visited by Mr. Beck, than any other collection in the world; while his collections in other families of South American water birds, notably the gulls, terns and ducks, also are unexcelled. All these specimens are deposited in the American Museum, where, through the generosity of Messrs. Sanford and Brewster, they are available for scientific investigation, as are the Museum's own collections.

Mr. Beck tells here of some of his experiences, and in due time it is designed to present a complete narrative of his explorations, as well as technical reports upon his collections.

FRANK M. CHAPMAN.

FULLY equipped for a summer's work in the Falklands, we left Buenos Aires in October, 1914. On reaching the islands, however, the unsettled conditions there due to the

still cruising German high seas fleet caused us to go on to Punta Arenas, Chile, from which place we started for a two months' cruise among the islands in the vicinity of Cape Horn. On our

¹ Article and illustrations copyrighted, 1917, by Rollo H. Beck

return from Cape Horn we found the high seas fleet reduced to one vessel and

While awaiting action on my bird collecting permit, I arranged to go



Some of the most accessible colonies of penguins are robbed yearly of their eggs. While the colony shown above was robbed of more than 25,000 eggs in 1914, a more fortunate colony three miles away was not disturbed and many thousands of young birds were reared. Wholesale robbery of these colonies for a number of years in succession would soon exterminate the penguins



The nest of the black oyster catcher is scratched in the gravelly beach above high tide, and one can find the two eggs merely by walking along the highwater mark

that one being carefully searched for, but the season was too late to attempt the Falklands then, and it was not until the following October that we finally landed at Port Stanley, the only town in the archipelago.

across the harbor, some five or six miles, with the captain of a small cutter to visit a gentoo penguin rookery. He was going for eggs to eat, while I took my camera—two cameras in fact, hoping to get some clear pictures of this

species which I had not yet seen. We started over the rolling hills in the direction of the colony. I had made the



The numerous rock hopper penguins and king shags on Kidney Island were apparently not at all averse to having their pictures taken. One does not need a blind to conceal his operations while photographing penguins or shags in the Falklands. A good raincoat, however, is desirable, as sudden snow or hail squalls are likely to drop out of some flying cloud



While the greater number of the rocky penguins will move aside for one passing through their colony, there are always some pugnacious individuals that rush boldly forward to hinder or hasten the visitor

acquaintance of the pugnacious rock hoppers and the secretive jack-ass penguins on Ildefonso Island to the westward of Cape Horn the preceding summer, but as we neared the first colony of gentoos and the birds began to move leisurely away from us, I was impressed at once by the marked difference in their size and the entirely different character of their nesting ground. On Ildefonso Island one had to select the second or third day of successive calm days even to land, and then had to climb with careful footsteps over slippery rocks to the muddy cliffs where the two species of penguins nest in the thick tussac grass. In the Falklands one lands by launch at the wharf from the Royal Mail steamers; and it is possible to mount a horse, visit the three species of penguins on their nesting grounds, and return the same day to the

steamer. This, I imagine, is seldom if ever done, however, as few of the passengers know of the proximity of birds in such numbers.

Although we entered the harbor on a bright sunny day and there were tens of thousands of penguins within ten miles of our anchorage, the only ones seen were a few dozen birds basking on a sandy beach near the entrance to the harbor. We found some of the nests of the penguins well lined with an abundance of twigs and small sticks, while others were merely shallow holes scratched in the ground. The common sea-bird trait of stealing its neighbor's nesting material was practiced whenever opportunity offered. Some birds more timid than others left their nests before we came near. Their bolder neighbors quickly took advantage of this action and began to rob the deserted nests of all the nesting material. There was a vast difference between the hurried snatching of a mouthful of twigs near by in a neighbor's nest, and the calm, judicial, unhurried selection of a desirable stick when an old penguin would stroll out from the rookery to gather additional lining for his nest.

When the birds of the entire colony were driven from their nests, some of them started off down the long lane toward the broad sandy beach a mile away. Others moved off a short distance and stood about until the egg gathering was over, and then promptly returned to their despoiled nests. When the sailors left for the boat, I went down to the beach where the penguins landed, but in a couple of hours returned to the rookery and observed four fresh eggs laid during my walk. I heard some weeks later that not a single egg was hatched in this colony, all being gathered by some one of the several eggers that visited it during the season.

The absence of land birds in the day's walk was quite noticeable, but the

lack of trees on the islands accounts in large measure for that. The close cropping and destruction of the tussac grass by sheep on all but outlying islets has driven the wren and tussac birds particularly away from the inhabited areas. On Kidney Island, fifteen miles away from Port Stanley, both these species were common although they were never seen about the town, and the wren especially was described to me as very rare by the Colonial Secretary when he delivered my collecting permit to me.

Hearing in Port Stanley of the numerous swans, grebes, ducks, geese, penguins, and various other birds that inhabited Bleaker Island about seventy-five miles to the southward of town, I determined to run down there, and hired a sloop for that purpose. The first night out of town we anchored at East Island, where I obtained fine sets of eggs of the beautiful pink-breasted black-headed gulls and the many skuas, and discovered also two turkey vultures' nests tucked away down at the foot of clumps of tussac grass each within a few feet of jackass penguin burrows. One little knoll harbored several tame rabbits which the owners of the island had liberated, and adjoining the rabbit knoll was a rocky headland which a colony of black-necked shags was using for nesting purposes. It was the most accessible site of that species I had ever discovered. Although hundreds of nests had been noticed on various islands, they were almost invariably over the water on sheer or overhanging cliffs, frequently in caves and virtually unapproachable. I took photographs of several nests; I also collected one or two birds, simply by grabbing the neck of the desired specimen and gathering him in as does the market man his caged poultry.

We left next day and reached our destination late in the afternoon. Bleaker Island, about twelve miles long by one wide, is devoted wholly to sheep raising,



NESTING SITE OF THE GENTOO PENGUINS

Our headquarters were at East Falkland for about three months, trips being made from that place to the various localities where work was to be done. Thousands of penguins were within a few miles of our anchorage. We found some of the nests well lined with an abundance of twigs and small sticks, while others were merely shallow holes scratched in the ground. After being robbed of their eggs the penguins return to their nests and guard them as carefully as though the eggs were still there



A SUNNY MORNING IN THE PENGUIN COLONY

On Bleaker Island, seventy-five miles south of Port Stanley, we found a large colony of gentoo penguins. The sitting birds are all facing the sweeping wind. In spite of the wind the young penguins like to get out from under cover and enjoy the sunshine



STUDY OF THE HOME LIFE OF THE KING SHAGS

It is not difficult to study bird habits in the Falklands because the birds are so little afraid. Mrs. Beck sat down beside a family of shags, and although they some-
 what resented her doing so at first, they soon calmed down and appeared as much interested in her as she was in them



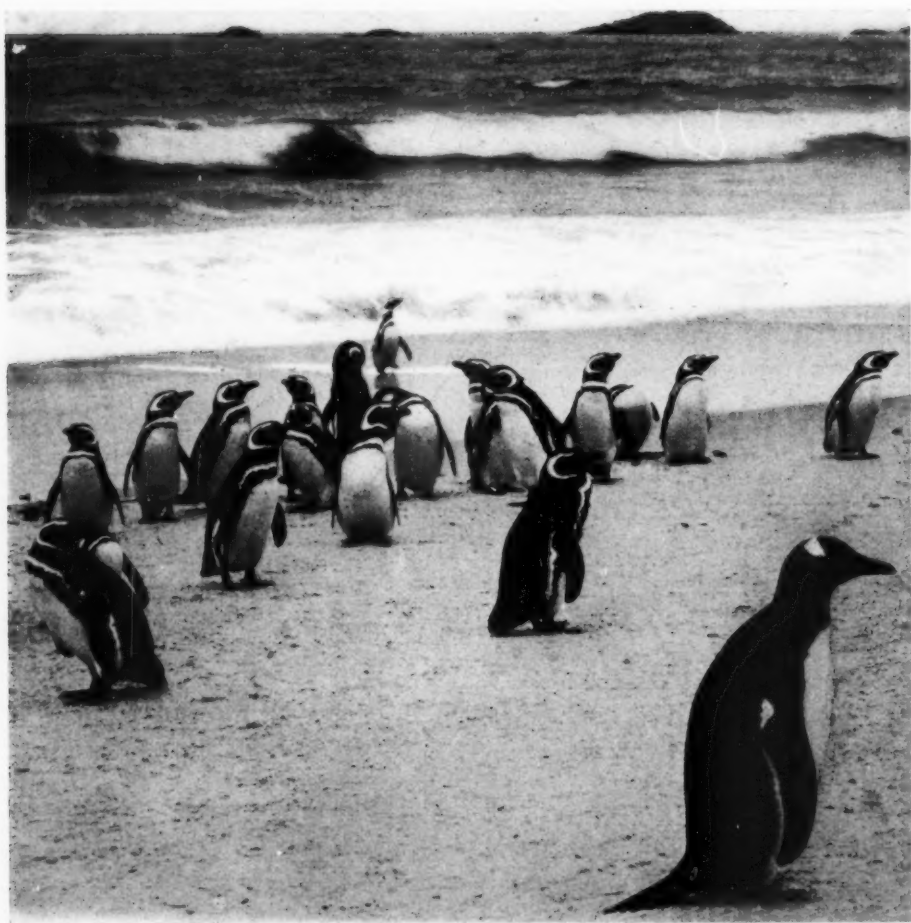
A KING SHAG ROOKERY

A thousand or more pairs of the handsome blue-eyed shags were nesting at the extreme west end of the island. White below and a glossy bluish black above, with a bright blue space about the eye, they far exceed our North American cormorants in beauty. The king shags usually nest among the rocky penguins, but occasionally an isolated colony is found. Snowy sheathbills nearly always are present and clean up the small bits of fish that may be dropped by the shags



KING SHAGS PREPARING FOR FLIGHT

The shags must paddle a few feet when rising out of the water, unless they are facing a strong wind.
The presence of tens of thousands of penguins, as well as great numbers of fulmars, shags, skuas, gulls, and smaller birds, makes the Falkland Islands an exceptionally fine field for bird photography



During the summer season many of the penguins that are not nesting come ashore and spend hours on the beach, a short distance above the water



In some places it requires a shovel and a couple of hours' digging to collect the eggs of the jackass penguin, while elsewhere, in walking over the ground of a colony, one breaks through into the nest without trying; for unlike the gentoo and rock hopper penguins this bird nests underground



While some of the black-browed or spectacled albatrosses nest among the penguins on top of West Point Island, many of the birds prefer to build on the cliffs where they can drop into the air as they step from the nest. On the overhanging cliffs a hundred feet or more above the tempestuous sea several night herons also were seen



Crested and teal ducks, and the brant and upland geese swim about together well within camera range in some ponds on Bleaker Island

supporting about three thousand sheep. Mr. F. A. Cobb, the owner, and his hospitable wife, insisted that we live ashore during our stay there. Being a bird lover himself, we found much in common to discuss.

The first day I started out with mag-

azine and plate holders full, headed for an upland goose's nest which Mr. Cobb had found a few days before, only a mile from the house. Before reaching it I flushed one of the pretty brown-breasted plovers from its nest under a diddle-dee shrub. After photographing



This pair of penguins (nesting about half a mile from the house on Bleaker Island) resent intrusion on the foot or two of soil immediately about the spot they have chosen for a nest and are ready with wing and bill to chastise any bird coming within reach



On Sea Lion Island a colony of giant fulmars was nesting. This bird, which is as large as some albatrosses, lays its single egg on the bare ground. The period of incubation lasts more than a month

that I walked on and saw the goose leave her nest before I neared it. She stopped a hundred and fifty yards from the nest and was at once joined by her mate who had been watching me from a distance. A skua, who also had been watching me as he circled about, sailed straight for the uncovered nest. While I stood watching the geese, the skua dropped to the ground about six feet from the tempting eggs. This was seen at once by the gander, who flew rapidly to the nest, evidently considering me a less dangerous enemy than the poaching skua. The nest was nicely lined and made an attractive picture with

diddle-dee leaves and blossoms all about it. Later in the day a crested duck was flushed from an open nest in a similar location. As the nest contained but two eggs I did not take them, but glancing back after I had passed a few feet, I saw a skua drop to the ground, pick up one of the eggs and fly swiftly away with it.

Tramping on to the eastward, I reached a bushy slope where the dominican gulls were brooding eggs. The nests were all well built, mostly of dry kelp which was abundant on the beach. I could not decide which was the best one to photograph, so went forward

again, intending to return later. I found more gulls' nests scattered along the coast line. One, close to the shore line, was placed in the hollow of a whale's bone that had been thrown on the beach in a storm. Along the high-water mark in one lonely cove a few terns had built nests, which contained eggs, and in the same cove a black oyster catcher called my attention to his nest scratched in the gravelly soil. Some sections at the east end of the island were so riddled with burrows of the jackass penguins that the shepherds could not ride their horses through the colonies. I more than once broke



The gentle king penguin builds his nest of tussac grass and roots, often bringing in from the sea a long piece of kelp to add variety to its lining. This bird is in the act of stealing his neighbor's nesting material, a common sea-bird trait practiced wherever opportunity offers

through the peaty soil into a penguin burrow, always extracting my foot therefrom with alacrity for fear of the powerful beaks of the penguins. At the far end of the island a pond was discovered which the ducks and geese used as a refuge while molting their wing feathers and bringing up their young. A small flock of teal and another of gray ducks swam about on friendly terms with the diminutive brant geese, although the latter were not on very friendly terms with an aggressive upland goose and his family that were also using the water as a safeguard against my too close approach.

As I rounded one of the points that jutted into the sound, a female kelp goose was seen ahead with four downy young birds, quite a distance from the shore. She saw me at once and started for the water with her goslings, while I hurried to head her back out on the open hillside, and reached the beach just in time to do so. After getting the young birds a safe distance from the water, I attempted repeatedly to set up the camera and get a picture of the group. The young birds would have stood all right, I think, but their parents (the male having joined us soon after he saw the tripod and camera a part of the landscape) would persist in leading them off. Sometimes the male would take one, two, or three of the youngsters and stride off in a different direction than that headed for by his companion; then I would herd them back together again. Finally I discarded the tripod and took a snap or two with the camera in my hand as the little family hurried away from me.

Returning along the other shore where rugged cliffs kept back the sea, several night herons' nests were seen. The locations were those usually selected by boobies or terns, duck hawks or bald eagles, rather than spots which night herons in the temperate region of the Western Hemisphere usually select for placing their eggs. They were all on

the overhanging cliffs a hundred feet or more above the tempestuous sea. Below, or near them, the black-necked shags were rearing broods. One pair had hollowed out the top of a tussac mound within thirty feet of the top of the cliff, and by using the long focus lens a photograph was obtained for a record, this being the only chance offered by this species that came to my notice. I was surprised to find it was four o'clock in the afternoon when the night heron's nest was left behind, and being three miles from the house, I set out for there without searching for other nests.

The next day began with a high wind which continued blowing all day, but it proved, I think, the finest day photographically I ever enjoyed. Starting toward the west end of the island, as eastward had been the course the day before, about two miles from the house the gentoo penguin colony was reached. Here young birds creched under the sitting parents, all faced toward the sweeping wind. Over the hill from the south shore, birds were continually coming into view, walking along their accustomed track, passing through flocks of feeding sheep at times, and usually finishing up the long walk with a hurried little run as they came down the sloping pasture to the rookery. It seemed very strange to me, as it does to other humans, that the birds should land on the south side of the island, walk a mile up a slope and down on the other side to place their nests within a hundred yards of the water on the opposite side of the island from where they land. One small colony of a few dozen birds had perhaps seen the folly of this procedure, for they had walked back only three hundred yards or so and built nests; but the overwhelmingly greater number spent an hour or more every time they left the beach to cross the intervening space between water and nest while beautiful landing places with deep water were within

two minutes' walk right at their back doors.

A short distance beyond the penguin colony a group of gulls was examined, and just beyond them, on a gravelly bar overspread with dry kelp, the darting terns had placed their eggs. A little higher on the beach and just back of the terns' nest an oyster catcher's nest revealed itself. From this spot I walked a long way over the closely cropped pasture, sometimes following the shore a short distance, in which case a screaming gull or else a beguiling oyster catcher, or perhaps both, would endeavor to distract my attention from their easily found nests. On one of these dips to the water I flushed a kelp goose from her nest close by the water's edge. It contained only four eggs but was heavily lined with white down which completely concealed the eggs when the bird walked away from it. Being placed between great bunches of decaying tussac roots, I could not get a view of the bird with the nest, but she and her mate were nearly as tame as the pair encountered the previous day with young. Back among the diddle-dee again one of the little white-chinned plovers was started from a nest containing two eggs and a newly hatched young bird. This nest was very similar in composition to that of the brown-breasted plover found on the east end of the island.

But it was at the extreme west end of the island that one of the most interesting sights met my eyes. There a colony of a thousand or more pairs of the handsome blue-eyed shags was nesting. Being white below and a shiny bluish black above, with a bright blue space about the eye, they far exceed our North American cormorants in beauty. Close along the windward side of the nesting birds sat more than a dozen skuas ready to snatch the eggs from any nest a negligent bird should leave uncovered. Just beyond the rookery along the edge of the cliffs sat about

twenty-five of the snowy sheathbills. In appearance they look slightly like winter ptarmigan, although in flight resembling pigeons. In summer they live principally on offal picked up about the nesting shags and the penguins. In winter small shellfish constitute their food. In the Falklands they are not known to nest, the breeding birds going south to rear their young. Several of the cormorants from the extensive colony were collecting material for their nests as I came near the site. They flew a short distance to the decaying tussac heaps and rapidly pulled out mouthfuls of the dead grass roots. Their quick nervous pulls at the tough roots were quite different from the leisurely style of the gentoo penguin in picking out its nesting material. Both, however, use the same furtive grasping method when it comes to helping themselves from a neighbor's nest.

On the journey back to the settlement in the afternoon, we visited a pond where several dozen geese were wading or resting. When they saw me swing toward them, all started for the beach, which was a short distance away. The entire flock swam out some distance from shore and waited until my departure before returning to land again. The greater number were molting birds and unable to fly, but they were joined by several others that flew toward them from some distance away. Although the English have occupied the Falklands since about 1832, and probably have been killing geese ever since, the birds at the present time show much curiosity toward mankind. I repeatedly saw geese that were feeding two hundred or more yards distant fly toward me and alight, frequently within gunshot. At one settlement near Port Stanley where I shot several geese for specimens, a whole flock walked up to within sixty yards of me, the feeding birds scattered over the hillside flying down to join them. This occurred with both upland and the smaller brant geese.

In several cases birds flew toward me to examine fallen companions; immediately after a gunshot and within plain sight, sound, and range of the gun.

I saw a half dozen swans and several grebes on Bleaker Island, but they were too wild to spend time on, so an extra trip to Sea Lion Island fifteen miles to the southward was planned. On Sea Lion Island a colony of giant fulmars was nesting, in addition to the penguins, shags, skuas, gulls, and smaller birds. A warm, sunny day favored me in taking pictures and several satisfactory results were secured. The nesting Scoresby gulls, placing their eggs in clumps of tussac grass so easily approached by penguin trails, were a delight to me after having gazed at nesting colonies from afar the preceding season, one colony on Hoste Island

being on top of a pinnacle rock, and another at Ildefonso Island approachable only by a seal or one clad in seal-skin moccasins and gloves to climb the slippery waterworn rock.

Although the day had been so pleasant, an increasing swell on the rocky reefs surrounding the islet warned the captain to be gone, and he sailed as soon as we were aboard. Stopping a day at Bleaker Island, while a shrieking gale blew over, an abbreviated visit was made by steamer to West Point Island, where the black-browed albatrosses nest, but our stay on the islands was cut short by a rumor that after the steamer in February called another would not appear before May. We left with regret the finest ground for bird photography that I have ever encountered in my wanderings.



The low rolling hills of the Falkland Islands are denuded of vegetation by large flocks of sheep. Just over the hill behind this sheep farm on West Point Island is a large colony of penguins from whose nests the farmer gathers his supply of eggs

BIRD LIFE IN THE FALKLANDS¹

REPRODUCTIONS IN DUOTONE FROM PHOTOGRAPHS TAKEN
DURING THE BREWSTER-SANFORD EXPEDITION
TO SOUTH AMERICA

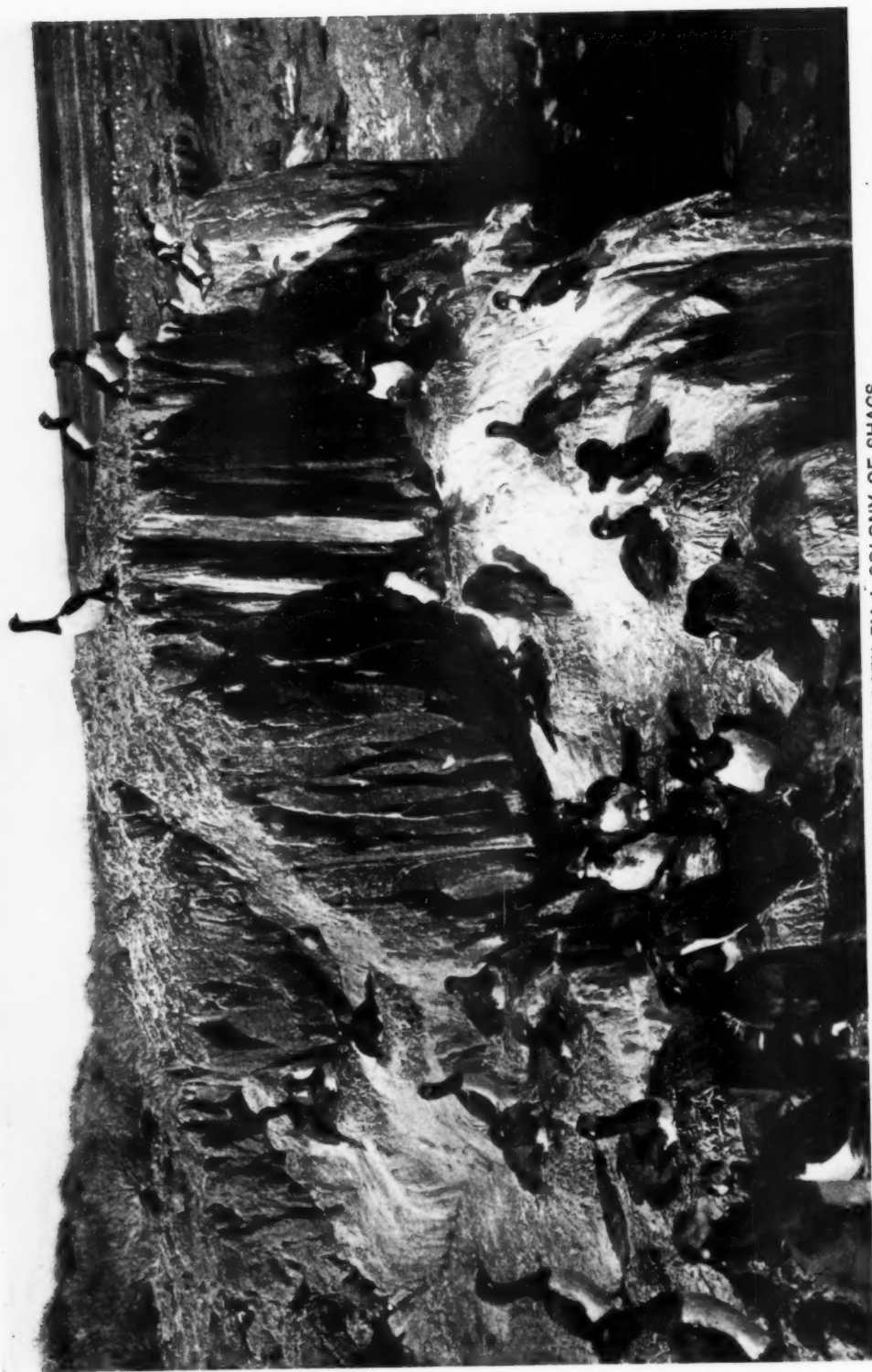
BY ROLLO H. BECK



GULLS ASTERN

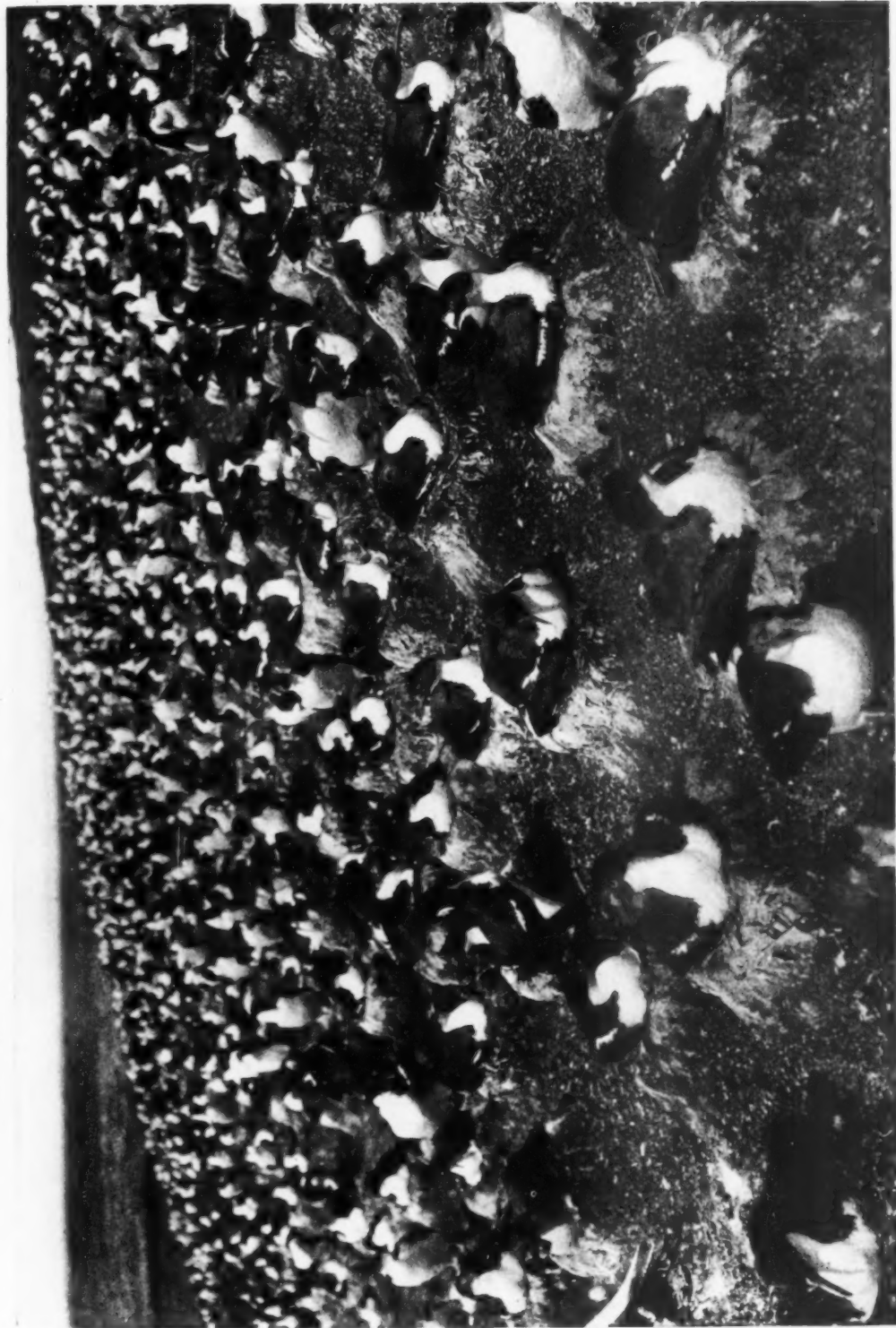
Dominican gulls that flock about the steamers traveling up and down the South American coasts are especially abundant at Port Stanley, Falkland Islands, where the Royal Mail steamers call. In the middle of the day a flock is always sitting astern of the steamer or flying alongside to pick up the pieces of waste food thrown overboard. Gulls' eggs are used in the Falklands for food, and when fresh are considered rather better than those of the penguins. The sheep farmers destroy the nests whenever found, as it is said gulls pick out the eyes of sheep that have become helpless by rolling on their backs and are unable to regain their feet again

¹ Illustrations and text, together with the preceding article, copyrighted, 1917, by Rollo H. Beck



UNUSUAL NESTING SITE CHOSEN BY A COLONY OF SHAGS

The black-necked shag, which with its larger relative the king shag, is found commonly about the Falkland Islands, builds its nest as a rule on the perpendicular cliffs over the ocean, often in dark caverns above the water, where, were it not for its white breast gleaming out of the surrounding blackness, it would never be discovered by the person rowing past in a boat. In this photograph, however, the birds are shown nesting on the top of a rocky cliff, a most unusual situation. This species generally fishes nearer the shore than does the king shag, and nearly every kelp patch along the rocks will have one or more birds of this kind in it, fishing for the numerous small fish that seek protection under the long floating leaves of the kelp.



EARLY BROODING KING SHAGS IN CROWDED QUARTERS

Although the king shags of the Falkland Islands are not so abundant as their cousins, the valuable guano birds of Peru, an occasional colony may be found containing upward of a thousand pairs. As in most large island colonies of sea fowl, the earliest nesting birds begin building close together, and by the time the late comers have built their nests, the first families have young birds hatched. The eggs of the king shag, because they are easily broken, are not gathered for eating, as are the penguin, gull, and albatross eggs—although small colonies of shags are often found associated with penguins in their rookeries



FAVORITE FEEDING GROUNDS OF DOLPHIN AND PINK-BREASTED GULLS

The dolphin and pink-breasted gulls shown above are not as plentiful in the Falkland Islands as their larger relative, the dominican gull. The bluish gray dolphin gulls may be encountered usually along the beaches, where they pick over the pieces of kelp for small animal life, or more likely can be seen out on the rocky ledges exposed at low tide, hunting for sea worms, and small crabs and other shell fish. The delicately colored pink-breasted gulls prefer feeding on live fish, darting down with the terns when a school of small fish approaches the shores. Both species of gulls begin to lay about the second week of December, while the dominican gull begins somewhat earlier



A ROUGH LANDING BEACH

The rocky or rock hopper penguins, when coming in from the open sea to land on the islands where they are nesting, pay little heed to the selection of a quiet landing place. They come from the water with a rush, jumping on to the rocky ledges, and often are swept back into the foaming swirl by an overwhelming wave before they can hop up out of its reach. Several hundred landed daily from the boisterous water shown in the photograph, and when safely ashore, usually would rest a few minutes before beginning to climb the nearly perpendicular cliff to the top of the island where their nests were placed.



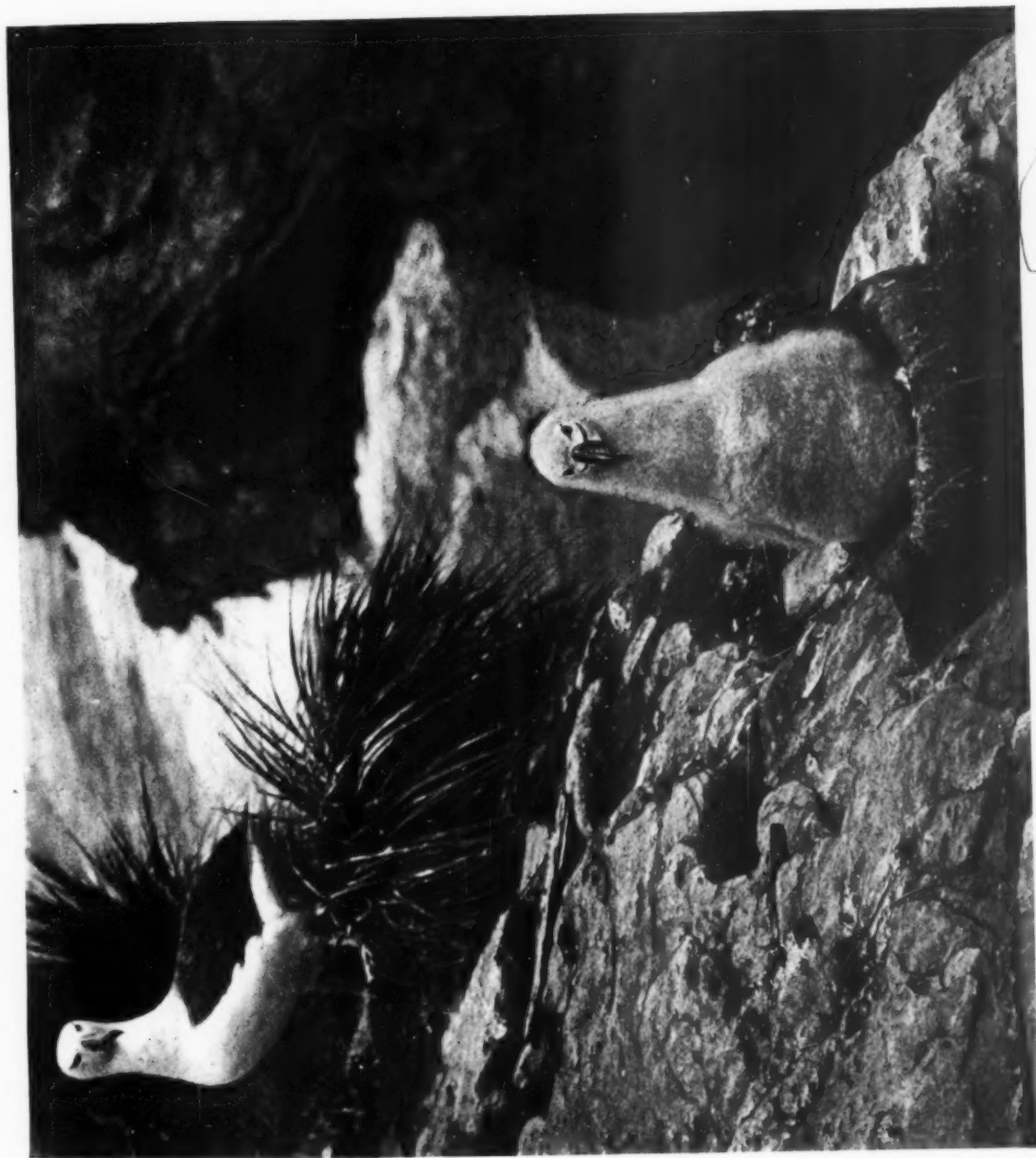
JUST BEYOND REACH OF THE SEA

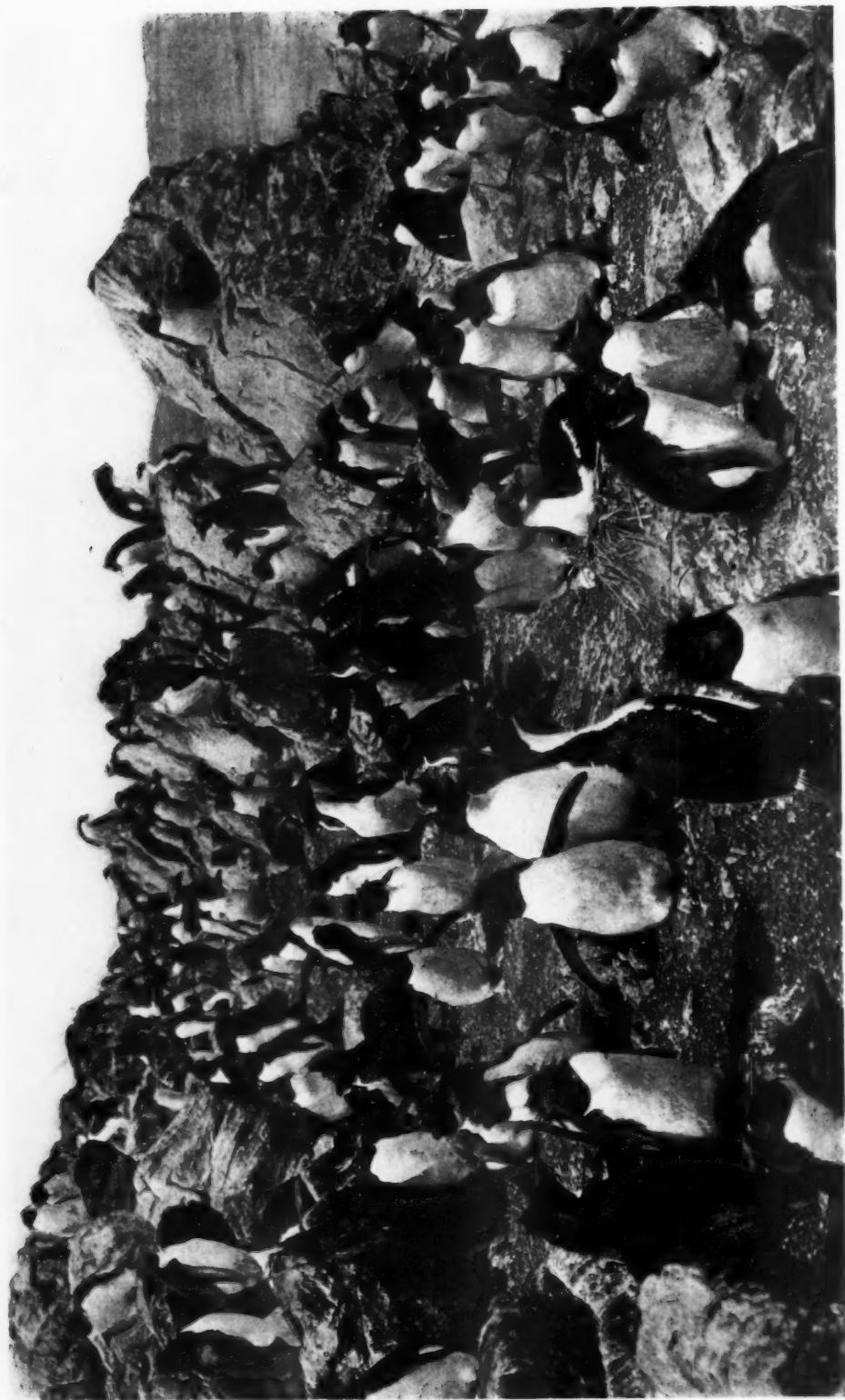
The kelp goose which nests throughout the Falkland Islands, builds its nest close to the shore line, quite often just above high water mark. At the right of this nest can be seen a piece of dead marine growth thrown up by a storm. The nest, when first seen, was a mere bundle of down which completely concealed the eggs, the bird having noted the approach of the camera man and hurriedly arranged the down over the eggs before she left the vicinity of the nest. The eggs rank higher as an article of diet than any of the penguin eggs, although the kelp goose itself is seldom killed, owing to its habit of living chiefly on marine vegetation.

bird having noted the approach of the camera man and hurriedly arranged the down over the eggs before she left the vicinity of the nest. The eggs rank higher as an article of diet than any of the penguin eggs, although the kelp goose itself is seldom killed, owing to its habit of living chiefly on marine vegetation

HIGH NESTING SITE OF THE BLACK-BROWED ALBATROSS

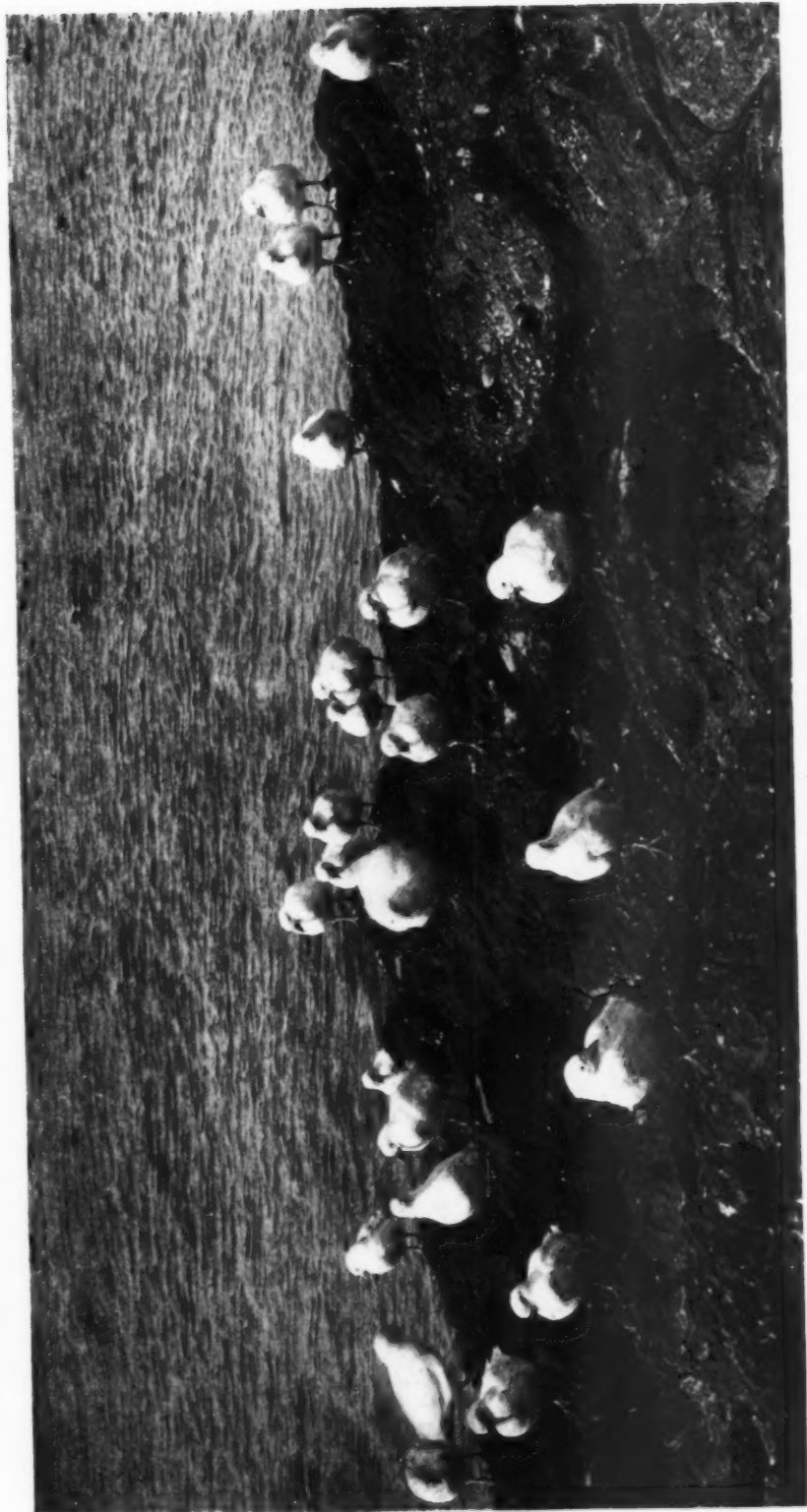
From the time that a steamer leaves Valparaiso on the west coast on its return voyage to Europe around the southern shores of South America and up as far as Buenos Aires on the east coast, there is probably not a day during the winter season that albatrosses may not be seen from its decks. While the magnificent wandering albatross, with his incomparable flight, is often seen, the commonest species is the black-browed albatross. There are several colonies of the black-browed albatross to be found in the Falkland Islands, and one or two about Cape Horn. The illustration shows a typical nest placed hundreds of feet above the tumultuous sea, close to the edge of a cliff on West Point Island in the Falklands. The bowl-shaped nest of the albatross resembles that of the flamingo, being built mostly of mud picked up near by. Many nests are used year after year and are built up gradually to a considerable height. The young albatross grows slowly, and it is some months before it can step from its nest and sail away over the wide ocean





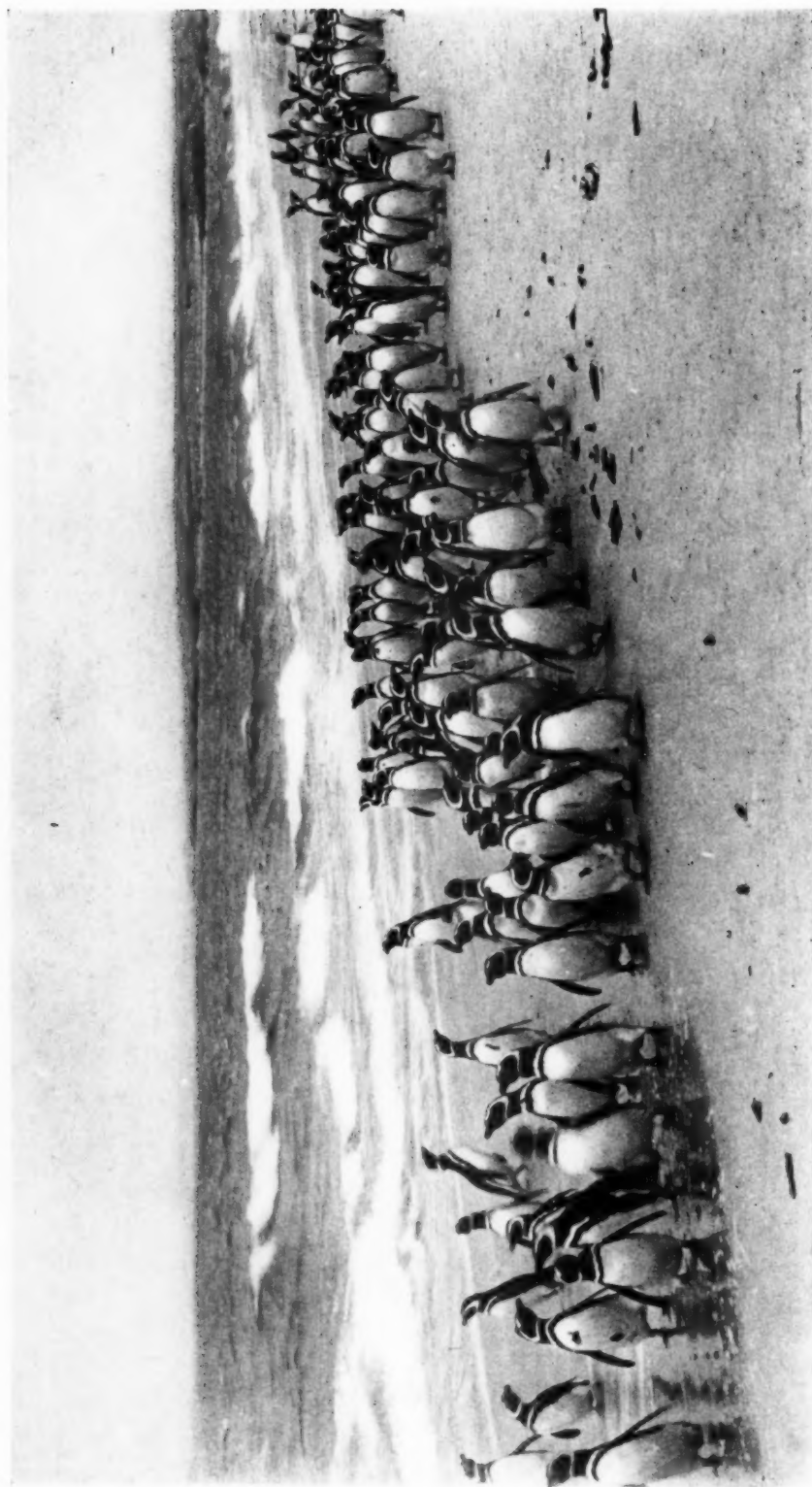
CHOOSING NESTING SPOTS ON CUCHON ISLAND

This small outlying islet about ten miles to the westward of Port Stanley in the Falklands, furnishes a breeding spot for a large colony of rock hopper penguins. Egg laying was just beginning when the colony was visited on November 6, 1915. Scattered pairs of king shags, which often lay their eggs among the rockies, were already brooding the two or three eggs which constitute the average clutch of this family in the far south. The above photograph was taken just at the top of a steep rock-strewn trail, and shows a pair of nesting shags, as well as the spot selected by several pairs of penguins, although but a single penguin egg is visible just behind the shag's nest



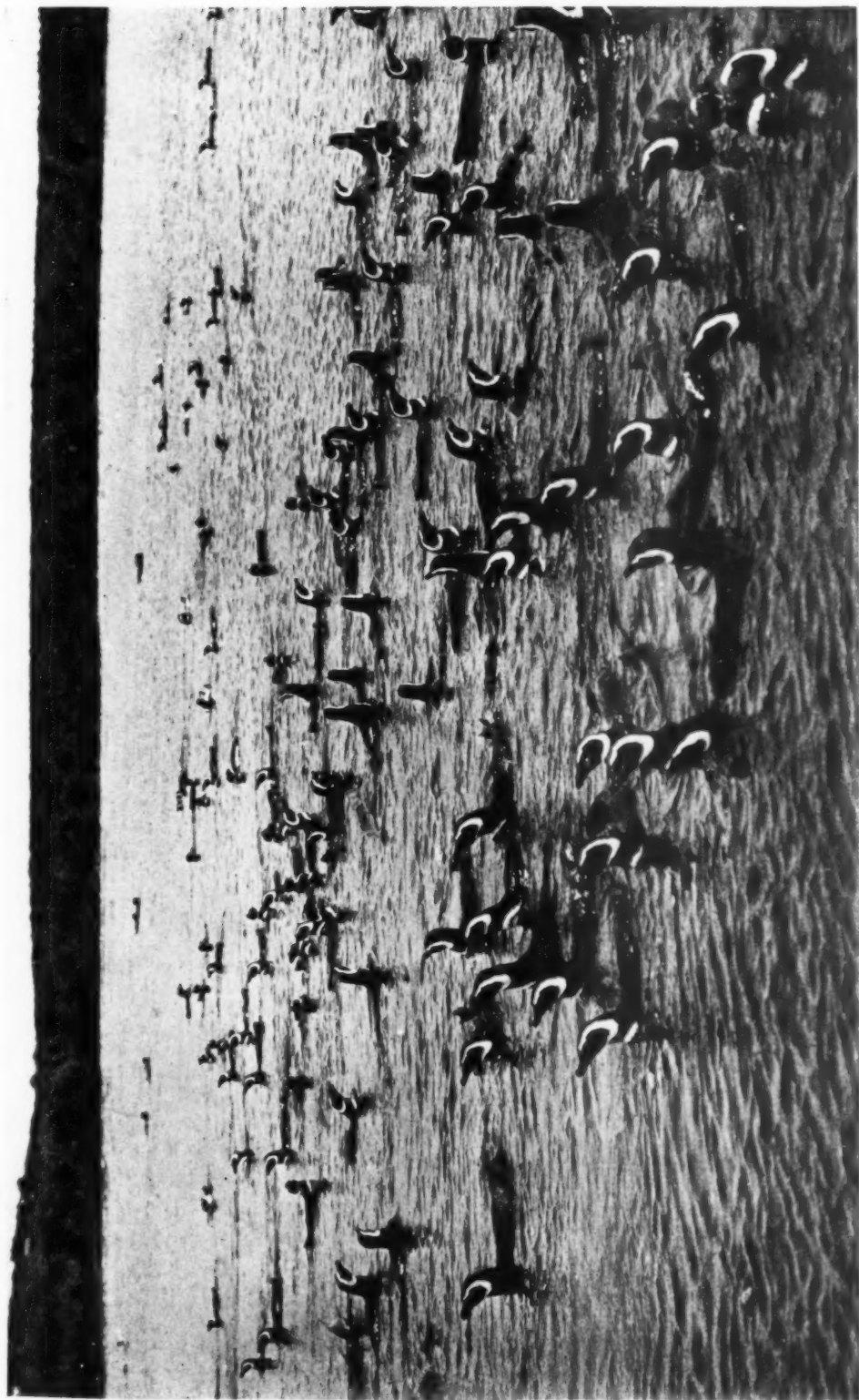
AN UNUSUALLY LARGE COMPANY OF SHEATHBILLS

The sheathbills, or kelp pigeons as they are known in the Falklands, are seldom seen in flocks of any size, the couple of dozen birds shown above being the most observed in any one spot. The presence of a large king shag rookery near by attracted these birds. In the nesting season the kelp pigeons hang around the penguin and shag rookeries, finding there bits of desirable food, but at other seasons they feed on the numerous small shell fish that are abundant everywhere along the rocky shores at low tide. The few kelp pigeons that remain in the Falklands through the summer are not known to nest there, the breeding ground of the species being on the islands farther to the southward



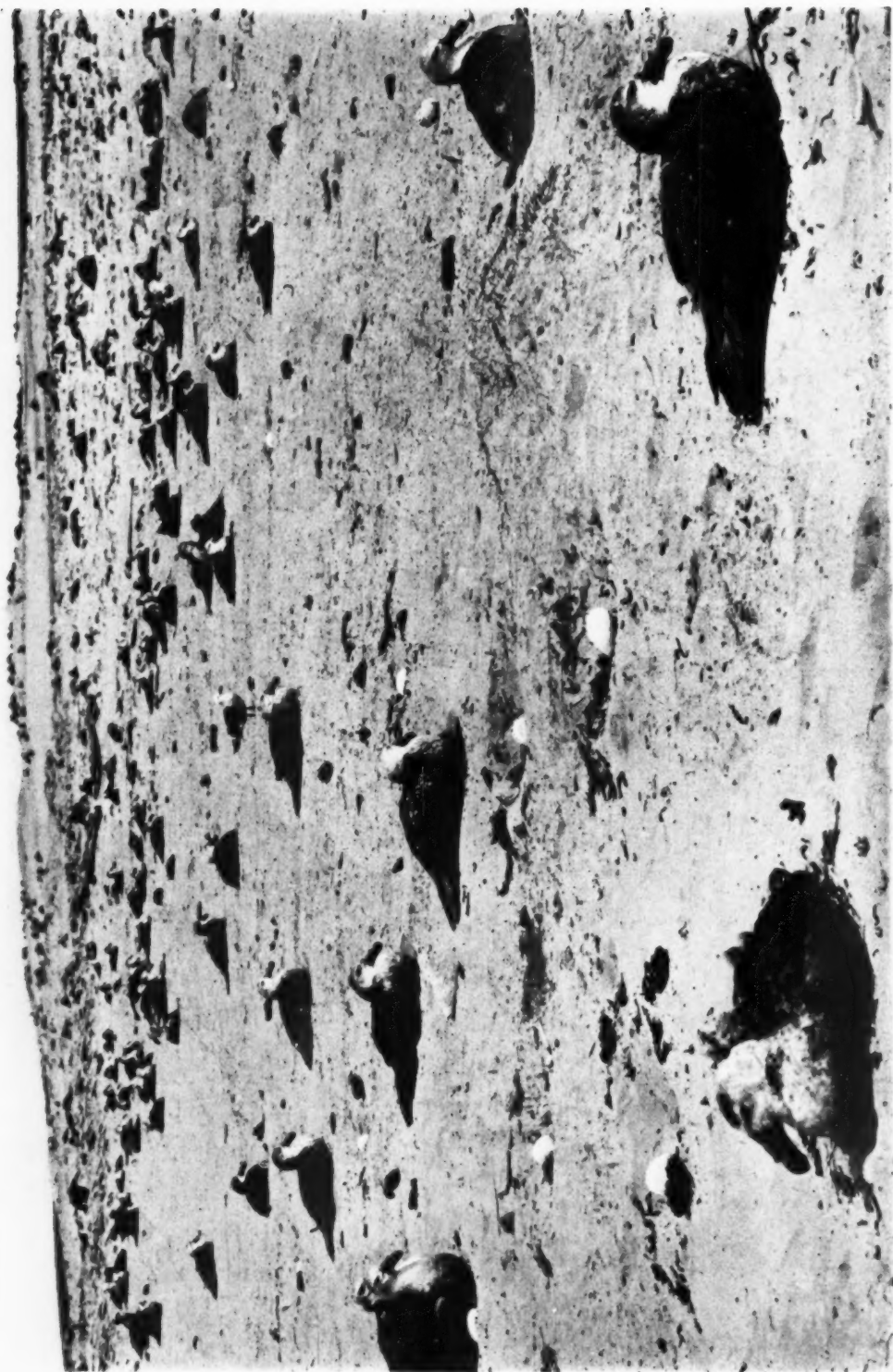
JACKASS PENGUINS IN A WIND-WHIPPED RESTING SPOT

In windy weather, which is frequent about the Falkland Islands, many of the penguins come ashore and spend hours resting on the beaches near the water. The above photograph was taken on a very windy day, the photographer approaching the birds on his knees, as this species is much wilder, for some reason, than the two other species which are common there also. At this same spot, on days less windy, the jackass penguins were seen darting to and fro like swallows in the curling breakers only a few yards from shore



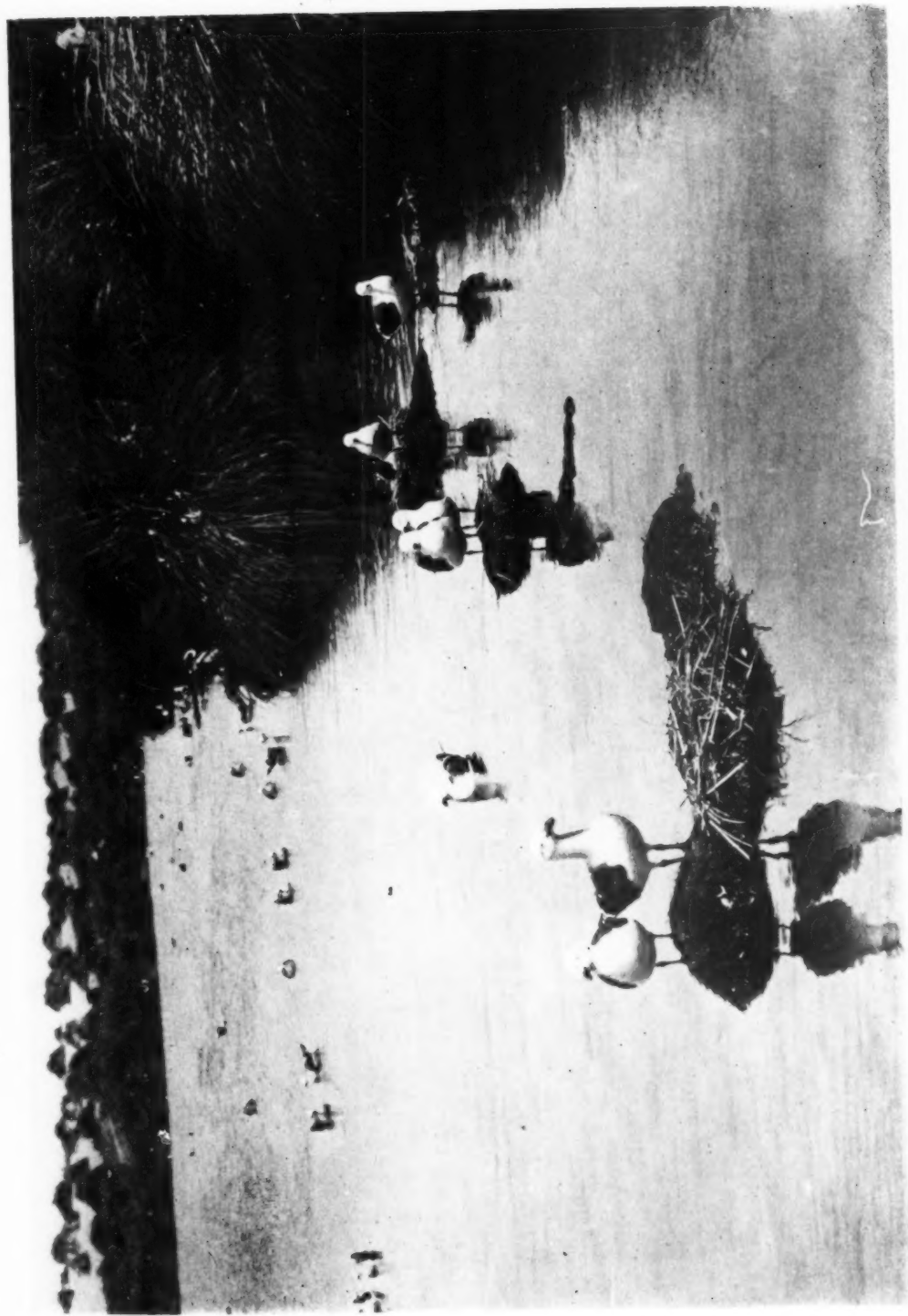
PENGUINS AT PLAY

An unusual sight in the Falkland Islands is to see a flock of playing penguins darting back and forth in a fresh-water pond. The birds shown above were dozing on the shore of a tussac-bordered pond when first noticed, but they entered the water and swam close along the sandy shore as their disturber walked alongside. The "melancholy bray" of the jackass penguin is heard most often about nightfall as he sits at the edge of his tussac-covered home. When the young birds are nearly grown, they join their parents at the entrance to their burrow, and if an intruder comes suddenly upon the family group, the scurrying hurry into the protecting shelter is most amusing to witness



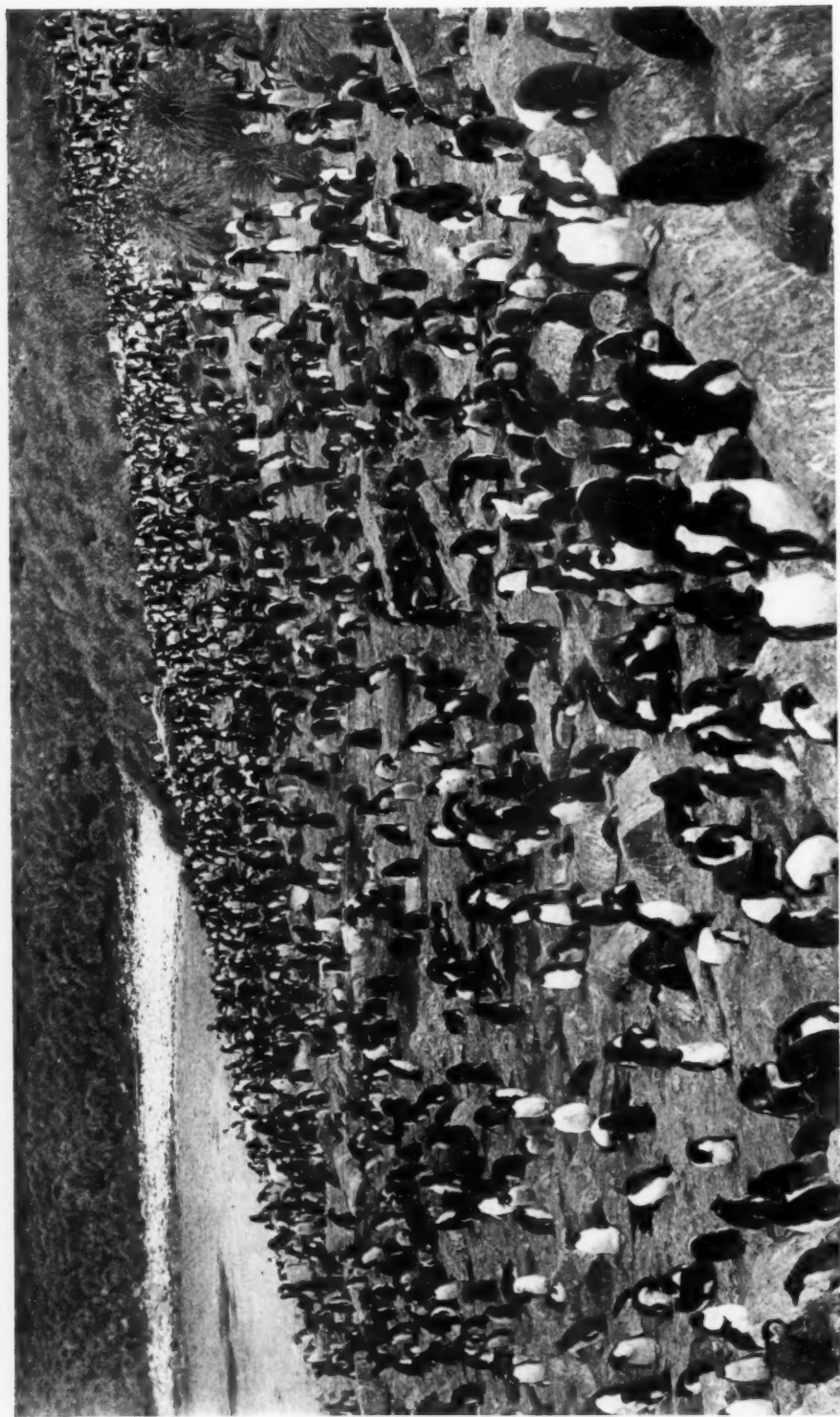
SANDY BROODING PLACES OF THE GIANT FULMARS

About a hundred pairs of birds were nesting on the flat sandy top of Sea Lion Island only a few hundred yards from the beach. Many of the birds from this colony made trips along the coast of East Falkland Island in search of food, a dozen or more being seen at times at least seventy-five miles from their nests near the harbor at Port Stanley. Birds of this species may be seen in winter in the harbor at Valparaíso, Chile, feeding with the gulls close along the rocks where the city garbage is dumped. They vary a great deal in color, many of those nesting farthest south in the Antarctic being white, while the birds seen along the Chilean coast are usually of a dark slaty type



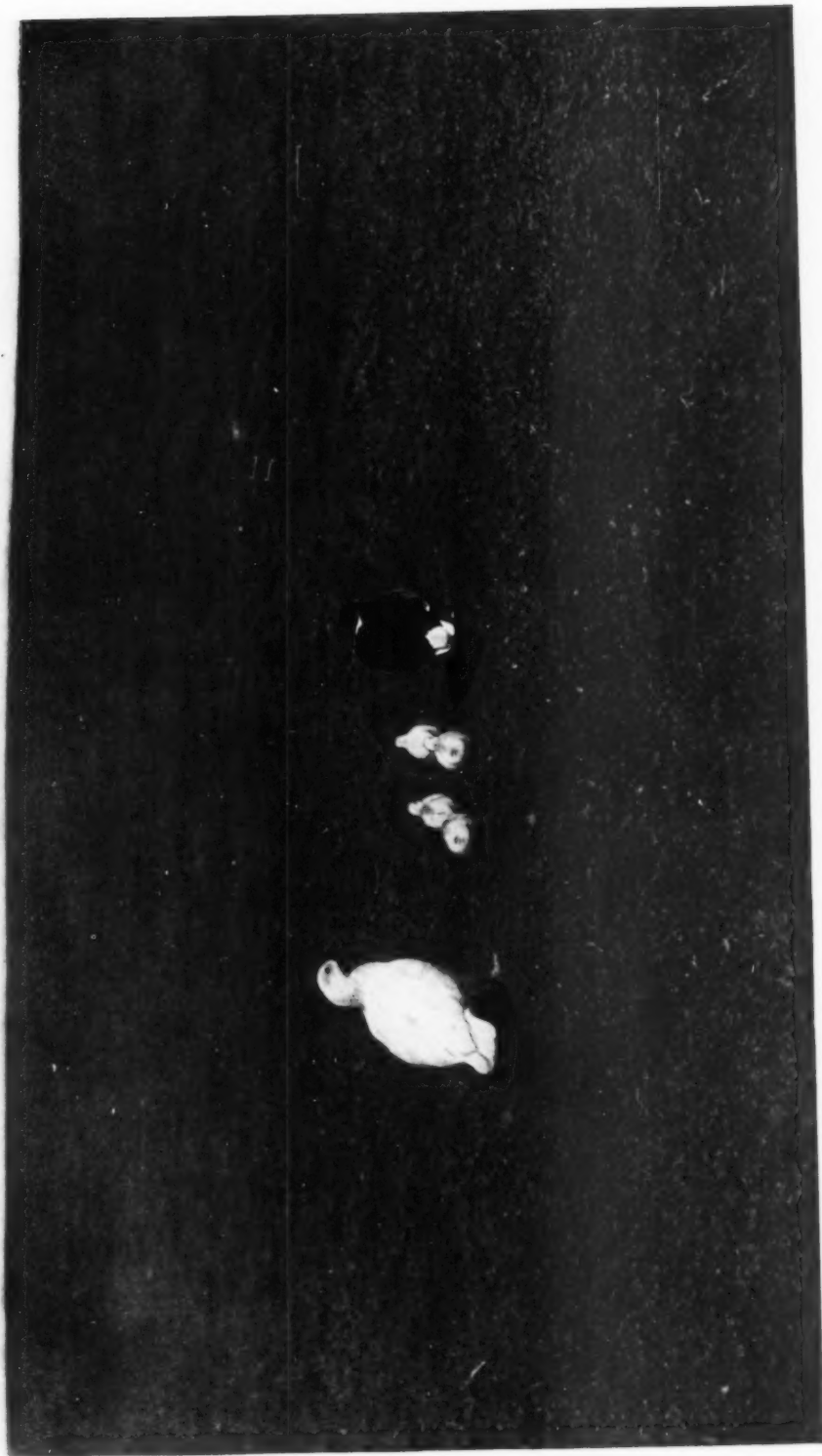
NEST BUILDING IN A FRESH-WATER POND

On Sea Lion Island a colony of the bluish colored dolphin gulls was discovered building nests along the edge of a fresh-water pond. A settler's house was about a mile from the pond, and his wife, who had a few chickens, was compelled to keep a close watch on the thieving gulls whenever food was thrown to the fowls. While we sat at lunch in the cabin, the roof was covered with gulls waiting for bits of penguin eggs which the lady of the house was giving to her chickens in lieu of other feed. These gulls are found about Cape Horn and the Straits of Magellan also, but they do not go so far north along the coasts of South America as the dominican gulls



A SOURCE OF EGG SUPPLY IN THE FALKLANDS

By far the commonest birds to be found in the Falkland Islands are the penguins, and of the four species occurring there, the small rock hoppers are probably as numerous as the other three combined. The above illustration shows the east end of the colony on Kidney Island about the middle of January, 1916. Many young birds can be recognized in the photograph, notwithstanding the fact that more than twenty-five thousand eggs were taken by eggers early in December from this same colony. When the young birds are perhaps two thirds grown, they leave their nests and gather in little bunches over the rookery. One sometimes can see a dozen or twenty of the youngsters huddled together. How the parents can select their own young from the mixed up assembly, when returning from the sea with food, is inexplicable to a human observer. The penguins' eggs are widely used in the Falkland Islands, many thousands being pickled and preserved for winter use. As a government license is necessary to collect the eggs, and as some colonies are seldom disturbed, it is likely that this excellent and inexpensive food will long continue to form a welcome change from the steady diet of mutton



FAMILY OF THE KELP GOOSE

Kelp geese usually keep their young near the beach line where, on the appearance of danger, the little ones may be taken into the water. The family shown above was surprised some distance from shore and was induced to walk away from the water for a few minutes that its photograph might be taken. The female kelp goose is beautifully barred with black and white on the fore parts; her companion is snowy white. The showy male is betrayed at a great distance by his color, while the broken pattern of the female renders her invisible at even a short distance on the dark rocks where the birds usually are found.



HOME OF THE DOMINICAN GULL

The nest of the dominican gull usually is placed near salt water in the Falklands—the one figured being in a typical location. The nests are well built with an abundance of grassy material, and it is often surprising to see how closely they blend with the surroundings, the birds being adepts in the art of *camouflage*. Three is the usual number of eggs laid. Since these eggs are decidedly larger than hens' eggs and as good eating, the nests are eagerly searched for about Port Stanley in the nesting season

Explorations in New Mexico

FIELD WORK IN THE LA PLATA VALLEY DONE BY THE AMERICAN
MUSEUM—UNIVERSITY OF COLORADO EXPEDITION, 1916

By EARL H. MORRIS

IT is now more than forty years since attention was first called¹ to prehistoric ruins in the valley of the La Plata River, northwestern New Mexico. Soon afterward, following in the wake of Ute and Navaho, white settlers found their way into the valley, and with their coming began the destruction of the aboriginal remains which for unnumbered centuries had held their own against the unbroken siege of time and weather. In preparing new fields for planting, grave after grave was ripped open by the plowshare, and the bones of the occupants tossed out to bleach in the sun, or to be pawed over during winter nights by coyotes. In the same way literally thousands of pottery vessels were exhumed. Some of them were smashed to bits on the plow beam to test their hardness, many of them were sent by the ranchmen as curiosities to friends and relatives, and the remainder passed into the hands of chance collectors who scattered them to the four winds.

By 1890 the discovery of the famous cliff dwellings of the Mesa Verde and the consequent awakening of interest concerning the ancient peoples of the Southwest created a market for so-called "Aztec" pottery. Because of the richness of the graves found by the ranchmen, relic hunters were attracted to the La Plata, and for the next ten years not a winter passed that one or more parties were not at work along the valley, turning burial mounds topsy-

turvy, and trenching back and forth through the remains of dwellings. During all this time not once was pen put to paper to set down the observations of the excavators, nor was any record kept of the specimens unearthed.

The problems of the archaeologist have not been rendered incapable of solution, however, although the deplorable havoc wrought by agriculturists and relic hunters has done much to complicate them. A few groups of ruins stand on land unfit for cultivation, and some of them are still relatively well preserved owing to the fact that their formidable bulk discouraged even the most enterprising pottery diggers. One of these groups is situated on a high mesa ten miles above the mouth of the La Plata. From the summit of the mesa one beholds a magnificent panorama of the surrounding country. Far to the south a bold escarpment beyond the San Juan River looms brown and blue against the horizon. To the northwest, above a wilderness of rugged cliffs, a black-green carpet of timber crowns the eastern rim of the Mesa Verde, while to the north the snow-clad crests of the La Plata Mountains rise, brilliant as frost crystals in the sunlight, or masked at times by banks of frowning clouds, from behind a chaos of clayey hills. In the immediate foreground to the east and south a silvery ribbon of river winds back and forth across a fertile valley. Fully six acres of the mesa top are strewn with remains of buildings and the black earth of refuse and burial mounds.

¹ By Dr. W. H. Holmes, of the United States National Museum.

The more compact of the two relatively large ruins stood on the very brink of the mesa. It had weathered down to a mound 8 feet in height covering an area 75 by 100 feet. In some places walls of cut sandstone were visible at the surface, indicating roughly the outlines of the building. From an estimate of the cubic contents it was thought the entire structure could be cleared in four weeks, but this calculation served only to reveal the impossibility of foretelling from surface indications what lies beneath the soil. Under the building which the mound concealed were the remains of two other dwellings, the walls of the most ancient extending twelve feet below the general level of the mesa. Before the last of these was uncovered four weeks had lengthened into nine.

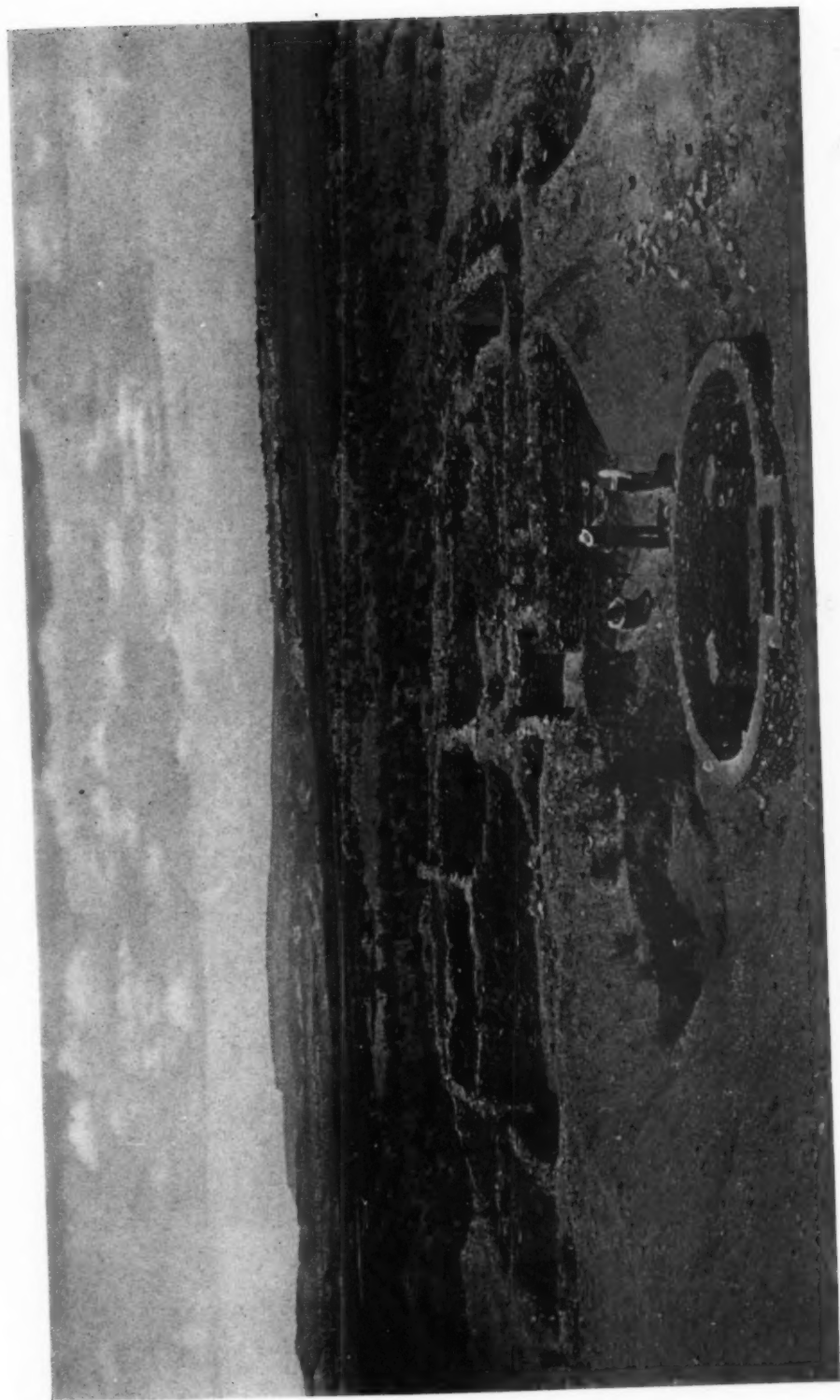
The three superposed buildings differed greatly in age and construction, and belonged to three distinct periods of occupation. The homes of the first inhabitants were subterranean in character. To construct them rectangular pits with rounded corners were excavated to the desired depth, and lined with a wattlework of sticks. Adobe mud was applied over the wattlework and gravelly floor until both walls and floor were smoothly plastered. From analogy it is to be supposed the roofs consisted of a number of heavy beams placed across the excavations, surmounted by a transverse layer of smaller poles, and rendered water-tight by a thick covering of earth. At some point, probably near the center of each roof, an opening was left which served the double purpose of an entrance for the inhabitants and a vent for the smoke which rose from a bowl-like fireplace in the floor.

In the course of time the builders of the pit houses abandoned the mesa,

leaving behind their household utensils where some of them were found, meal-ing stones leaning against the walls, stone axes and bone awls scattered over the floors, and occasionally a crude bowl or globular pot reposing in a sheltered corner. More perishable materials such as wood, basketry, and matting had completely decomposed. For perhaps a century or two the elements labored to obscure all traces of the subterranean dwellings, and succeeded in filling them up partly or in some cases completely.

Then another group of people took possession of the mesa and erected above the ruins of the pit houses a compact, thick-walled community house of cobblestones and mud. The ground plan of this structure seems to consist of about forty rectangular rooms, and from the amount of fallen masonry there may as well have been twenty more in a second story. In front of the building, which faced south, four circular chambers, averaging fifteen feet in diameter, were dug down through the remains of the pit houses, and carefully walled with stone. From a study of Pueblo tribes as described by writers who accompanied the Spanish conquerors, we know the significance of these circular structures, and their relation to the rest of the village. The main dwelling belonged to the women, while the men of each clan owned an underground kiva or clubhouse in which they slept and spent most of their time when not engaged in agriculture and the pursuit of game. These kivas were the ceremonial centers in which councils were held and ritualistic rites performed. Upon such evidence may be based the conclusion that four clans built and maintained this village of the second period.

If one may judge from the enormous



GENERAL VIEW OF THE LA PLATA RUIN

From a shapeless mass of cobblestones and earth it is difficult to visualize a terraced dwelling, but the spade soon brings order out of chaos and reveals not only the lower walls of the building but also many manufactured articles left behind by the departing inhabitants. Many of these heaps dot the La Plata Valley, marking the former homes of a people who raised their corn along the river and hunted deer in the hills. The fortress-dwelling here illustrated contained twenty-five rooms and two subterranean council chambers. One of these chambers, seen in the foreground, was part of an older structure built on this same site. Beyond this ruin a heap of stones marks another one. In the distance rises the eastern rim of the Mesa Verde



A RUIN UPON A RUIN

Features of two of the three superposed buildings may be distinguished in this picture. The few courses of faced stone represent the lower portion of the south wall of the most recent structure, while below them, to the right of the shovel, a wall of the cobblestone house runs at an oblique angle beneath the later ruin. Sixteen feet of earth was removed in reaching the floor of the circular chamber in the foreground. Much of the success of an archaeological expedition depends upon the interest and devotion of one's helpers. For thirty years Bill Ross has worked among the ruins, developing a positive genius for locating specimens in unpromising places

quantities of sweepings, ashes, broken implements, and potsherds with which they filled all the depressions about their town, and heaped up considerable mounds beside, these four clans continued long in residence. When eventually the building was abandoned, everything inflammable was destroyed

years, the Pueblos returned to build again upon the mesa, they brought with them a skill undreamed of in earlier times. On the slight elevation resulting from the decay of the cobblestone house, they marked off an area eighty-six by fifty-four feet and erected upon it a two-story structure of faced sand-



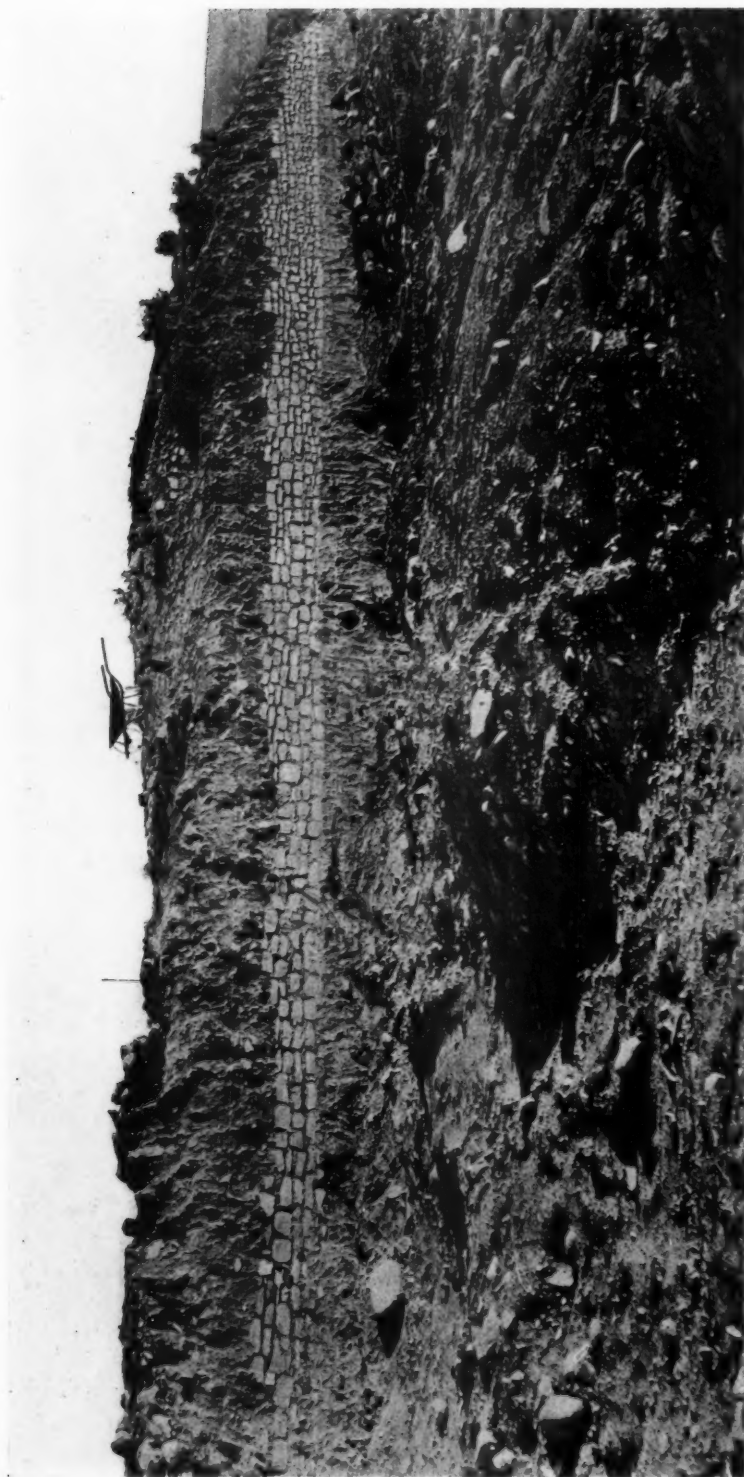
The circular subterranean clubhouse owned by the men of each Pueblo clan, from which the women were excluded except on special occasions, served as sleeping quarters and council chamber. The round pit seen in the foreground is a fireplace, while the rectangular area slightly above and to the left of it is the opening through which fresh air entered the room. A tunnel connects this opening with a shaft outside the curving wall which leads to the surface

by fire. Previous to the conflagration, however, all manufactured articles except a few corn mills, half a dozen stone axes, and one broken water jar were removed, but whether by the departing population, or by looters, we shall never know.

Nature resumed her work of obliteration, while in other centers aboriginal architecture continued its slow development. When, after a lapse of many

stone blocks. So accurate were their calculations that the corners varied less than five degrees from right angles, and in spite of centuries of settling, when uncovered, the bases of the walls were as straight as if the masons had trued them in with line and level only the day before.

Enclosed within the rectangle there are twenty-five secular rooms and two kivas. Throughout the masonry is



NORTH EXPOSURE OF THE MOST RECENT OF THE THREE SUPERPOSED RUINS

So skillfully were the walls constructed that they called forth exclamations of surprise from masons who came to inspect them. The débris beneath the base is that resulting from the decay of the older ruin upon whose remains the sandstone structure was erected

excellent, but notwithstanding their smoothness, most of the walls of the living rooms were finished with adobe plaster. One of the kivas is as fine an example of Pueblo architecture as has ever been unearthed. After the curving walls were constructed, they were rubbed and polished with sandstones till the surfaces were smooth as a planed board. A room near the eastern end of the building has a small portion of its walls ornamented with incised geometric patterns. This beginning of mural decoration marks the highest stage to which Pueblo architecture attained, and without corroboration would have shown the structure in which it occurred to have been of relatively late construction.

The only entrance to the building was through a narrow doorway in the center of the south wall. This opened into a small hall from which ladders reached to the roof of the first story. To gain entrance to the lower rooms it would have been necessary to go down through hatchways by means of other ladders, but between the rooms on each floor there were diminutive openings through which one might pass on hands and knees. With sheer outer walls and but one door, the building constituted a fort as well as a dwelling.

Like the one beneath, this edifice had been stripped of everything of value, so that the only specimens recovered were about a bushel of pottery fragments and two small pots which had been buried under a floor with the bodies of children. The fragments were enough to establish the type of ware and style of ornamentation characteristic of the pottery correlated with the sandstone structure, but as it was desirable to supplement the fragmentary material with whole or restorable vessels, the burial mounds north and south of the

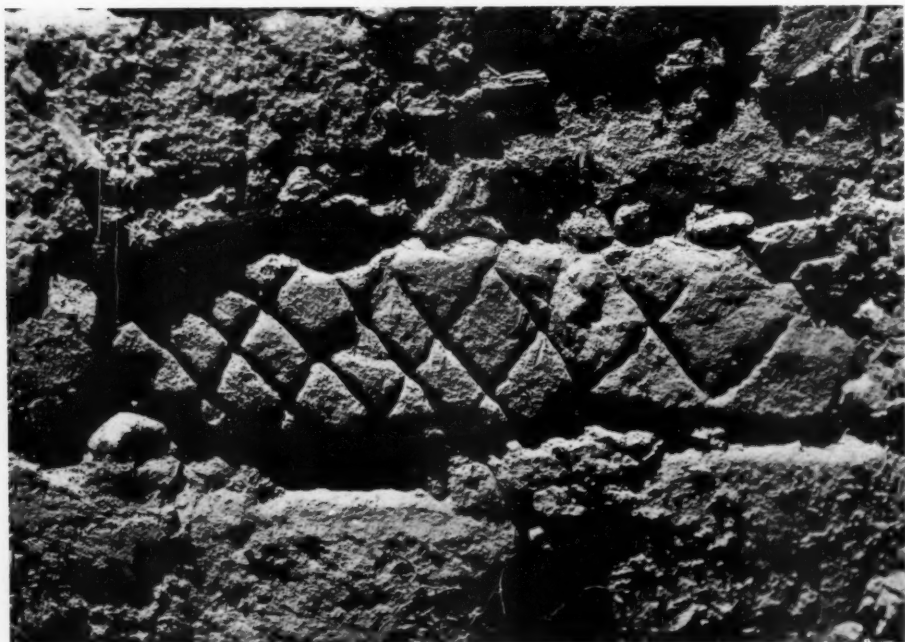
village were opened. They yielded one hundred skeletons, and as many beautiful pottery vessels.

There is something indescribably fascinating about the excavation of a burial mound, and the intentness with which all of one's faculties are centered upon the work develops a surprising keenness of perception and discrimination. In a short time it is possible to tell a fragment of decayed human bone from that of another kind of animal merely by crushing it between the fingers, because a human bone reduces to a flour-like powder, while that of a wild animal breaks up into a granular, sandy substance. Some slight difference in the quality of the vibrations which travel up a shovel handle when the blade strikes a hard object, informs one whether the obstruction is a stone or a pot. Many features of the work conspire to place upon one the spell which binds the prospector and the gambler.

For weeks Bill Ross, the writer's most trusted workman, had been eager to open one refuse mound which an intuition born of thirty years' experience among the ruins caused him to suspect of containing many graves. At length he was given the opportunity, and toward noon of the first day he beat a tattoo on a shovel-blade from the pit in which he was at work. It was a signal for all hands to gather, for no one can be expected to labor when a "find" is being made. There in the side of the excavation he had uncovered a thigh bone, brilliantly yellow as fossil ivory. In a few minutes the position of the skeleton was determined. The body was that of an adult buried upon its back, with arms at the sides, and knees elevated. Resting upon the abdomen there was a beautiful bowl, within the bowl a long and graceful ladle, and beside it a little cooking pot.



Frost action and the settling of the soil have broken most of the pottery buried with the dead, while burrowing animals have scattered many of the fragments. Running the earth through a screen often results in the recovery of all the pieces of a vessel



Ornamented building stones have been found in one ruin in the La Plata Valley, and in Sun Temple and one or two dwellings in the Mesa Verde National Park. They indicate the beginning of mural decoration which marks the highest stage of development reached by Pueblo architecture



Pottery vessels, shell bracelets, and necklaces of beads and turquoise are often found in Pueblo burials. Scarcely a foot of coarse gravel covered the vessels here seen, which were so coated with lime that the painted designs were entirely obscured



In an abandoned dwelling larger pottery vessels may often be found standing where they had last been used. This fine vase was buried under eight feet of earth, the foundation of a later structure having been placed directly over it



POTTERY WAS BURIED WITH THE DEAD

Here was found an adult, buried beneath four feet of refuse. The body lay upon its back with heels drawn up against the thighs and knees elevated. Upon the abdomen had been placed a large bowl and ladle of exquisite workmanship, and beside these a small, graceful cooking pot. The decayed skull may be seen to the left of the pottery vessels

Another grave had been cut down into the natural soil below the refuse. The body was lying flat upon its back, and the pit had been roofed over with cedar logs which were weighted down with stones. Two bone awls and an arrowpoint were by the right hand, while around the head were grouped a pitcher, a bowl, and two ladles. On the extreme outskirts of the mound lay a skeleton with knees drawn close up against the chest, and arms flexed with hands at the shoulders. Although the skeleton lay near the surface, and was covered with large stones and gravel, this person must have been well thought of, for in front of the face reposed a bowl, a pitcher, a ladle, and two cooking pots. Curiously enough the three graves in this mound represent the typical positions of burial—on the back with knees elevated, on the back with legs extended, and on the side with arms and legs flexed.

Fragments of pottery from the three buildings clearly revealed the type of ware and ornamentation characteristic of each period of occupation, and from them it was possible to establish the relative age of many of the graves. Only one was found which belonged to the people of the pit houses, and but three which dated from the time of the sandstone structure, while about thirty belonged to the period of the cobblestone dwelling. The remainder of the bodies were buried without pottery, and nothing could be told concerning their antiquity, since there was no discoverable correlation between the positions of burial and the age of the graves.

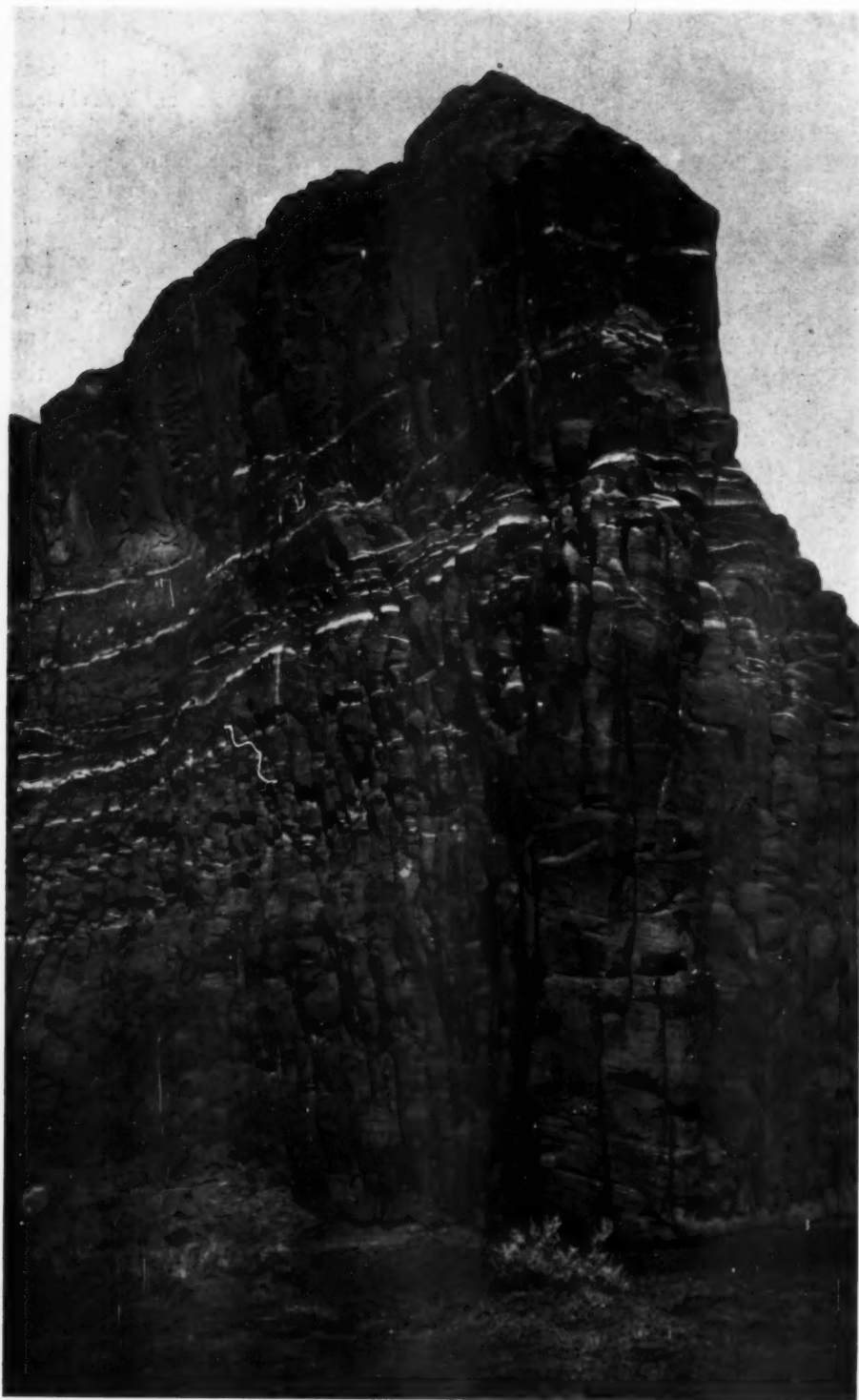
To summarize the facts gathered from the La Plata excavations: three times the site was inhabited by groups of people each of which had attained higher architectural ability and mechanical skill than had the group pre-

ceding. Centuries must be taken as units to measure the time which elapsed between the periods of occupation, and other centuries must be added to allow for the great accumulation of refuse accompanying the different types of buildings. And from a comparison of pottery types, it is proved that even the sandstone structure had fallen into decay before America was discovered by Europeans. Then one may risk the statement that at least fifteen hundred years have passed since the people of the pit houses migrated into the La Plata Valley.

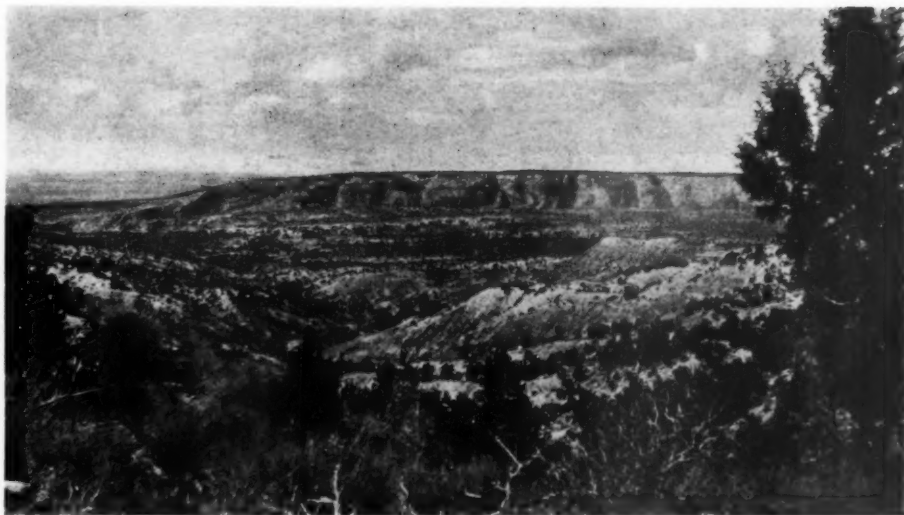
The dwellers in the pit houses made relatively little pottery, and rarely ornamented it with painted designs, but the people of the middle period made great quantities of excellent ware which exhibits a profusion of shapes. Of these the most typical are drinking vessels with globular bases and restricted necks, and ladles in the form of one half of a gourd which has been split longitudinally through the center. Curvilinear geometric patterns applied in black and red-brown pigment are the characteristic ornamentations.

During the third period the pottery was very little better than that of the second, but it presents several features which give it individuality. The half-gourd ladles are supplanted by ladles with tubular handles, and the pitchers with globular bottoms are replaced by the flat-bottomed mugs common among the pottery from the Mesa Verde.

Such points make possible a historical reconstruction of the parallel development of architectural and ceramic types. By a close study of the evolution and distribution of these types it will be possible eventually to map the routes of Pueblo migration, and probably to tell whence the ancestors of the Pueblos came into the Southwest.



A SENTINEL OF THE NAZLINI CAÑON



Nazlini Cañon, except for the difference in size, is quite as beautiful as the Grand Cañon. Its coloring of gray, green, and red suggests the Painted Desert

Through the Navaho Region¹

By HOWARD McCORMICK

Illustrations from photographs by the Author

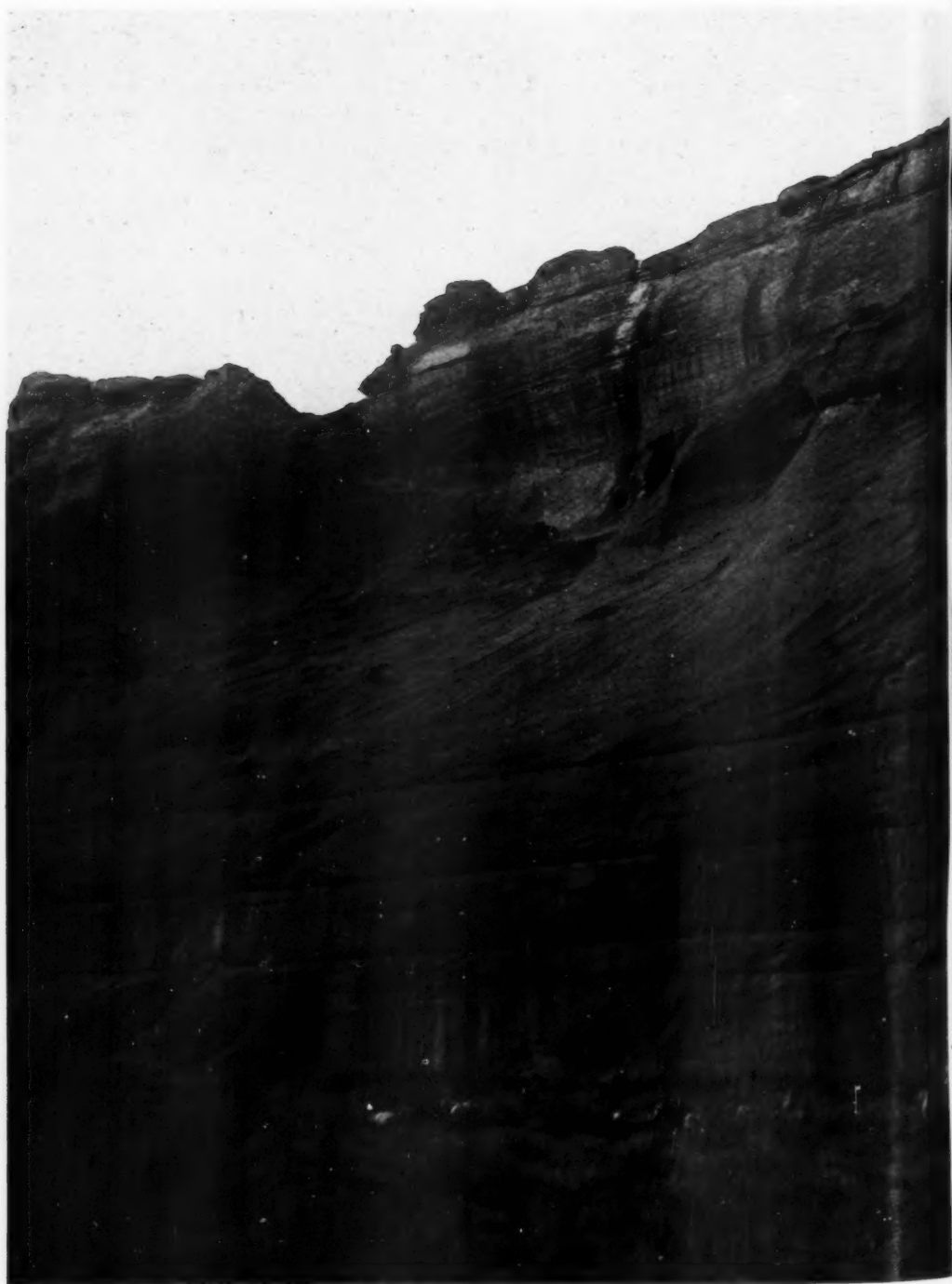
WHEN we think of strange races of people, quite different from those about us, we turn to the far limits of travel. But within three days' time from New York, we can be among people whose life is as strange and as far removed from our own as one possibly could imagine.

Let us take the Santa Fé railroad to Gallup, New Mexico. Gallup is a characteristic western town. The main street is lined with stores of general character—and has several saloons. Beyond these are the trading supply stores, then we pass through the residential district into the Mexican quarter, which dwindles into the poorer quarters, thinned out to packing-box

houses built in crevices of the rocks. Still beyond we enter the characteristic Arizona landscape of sage and low hills.

Six years ago, in order to go from this point up into the Indian country, we caught the mail wagon and after a day's journey reached Ganado, the first trading post. Now, we jump into an automobile and are whisked up in four hours. The country gets higher as we proceed, extending into wide valleys between the mesas. St. Michaels, a Catholic school with its hospitable priests, is the first stop, after which we ride for fifteen miles through a beautiful pine forest, as trim as though artificially tended like a private estate. Ganado we can find marked on the map, but in reality the place consists of

¹ This trip was taken for the purpose of making sketches and obtaining materials for the Navaho group which is being installed in the American Museum as a companion piece for the two habitat groups already completed. The new group is ceremonial in character, depicting the interior of a *hogan*, with sand paintings, in which a medicine man and other Indians are going through the *yeibetsai*, a ceremony for healing the sick.



CAÑON DE CHELLY

At this point the rock wall of the cañon rises precipitously to a height of at least six hundred feet. More than 160 ruins may be seen in this great gorge, the most conspicuous and interesting of these being the "White House," which at present is practically inaccessible



THE "WHITE HOUSE"

From our camp on the opposite side of the cañon the white buildings of the ruin gleamed from out the cave like two teeth in a wide mouth. Thirty feet below the "White House" is another ruin, which is being washed away rapidly, disclosing beneath it a third

only a mission and a trading post. Indians gather here to trade, however, from miles around, coming even two hundred miles and passing through small trading posts on the way, largely out of friendship for the trader.

If one chances to be at Ganado any summer about the first of August he is likely to find from fifteen hundred to two thousand Indians gathered together for games, such as horse racing and chicken pulling. Originally a "chicken pull" was a game in which Indians on horseback tried to pull a chicken out of the sand while riding past it at top speed. Today a leather strap is substituted for the chicken, and the Indian who pulls it out gets five dollars. As soon as he succeeds in getting hold of it, he makes a wide circuit with several hundred Indians after him. If he can fight them off and return the strap to the judge, he gets an additional two dollars. This annual gathering, corresponding in a way to our county fair, means a great deal to the Indians because it gives them an opportunity to renew old friendships.

From Ganado to the first Hopi villages is about sixty-three miles. The snake dances occur in these villages every year, two dances with four every alternate summer. If the trip is made in the fall, there is an opportunity to see Navaho dances instead, performed usually for the curing of the sick. We were so fortunate as to have these Navaho ceremonial dances given near our headquarters.

To an outsider the most interesting part of the performance is the dance which begins on the night of the last day. The dancers arrive in groups of from ten to fifteen from various parts of the country, and the whole affair resolves itself into a competition among the various groups for the best singing and dancing.

The setting of the scene is picturesque. Two lines of camp fires edge the dancing ground in front of the *hogan*; hundreds

of Indians fill an amphitheater on either side, with covered wagons for a background. The Indian dance costume is along fairly definite lines, but considerable latitude is allowed in the way of kilts, which are usually made of variously colored velvet and ornamented as the individual's fancy may dictate.

The competing groups of dancers enter the plaza one after another, always in energetic action, but always in single file. As the night wears away the violence of the action increases until at dawn it has reached the maximum. For the observer the night is one of charming and picturesque effects, but perhaps the most impressive comes at the moment dawn breaks over the mesa. The light of the day slowly overcomes the light of the camp fires, revealing the dancers enveloped in swirling clouds of dust, and all the picture near and far takes on a cool gray tone. The singing dies away and the dancers file out. The dance is over. Indians here and there rise and stretch their stiffened limbs and begin to move about. Coffee pots are pushed up to the fire for a hasty breakfast and within an hour all are on their way.

We packed our camp kit and departed with the Indians. Our route lay toward Chin Lee and the Cañon de Chelly, eighteen miles from Ganado. After traveling through forests of piñon and juniper, we suddenly came upon Nazlini Cañon—without warning the car shot out to the brink above the cañon five hundred feet below. Aside from difference in size, Nazlini is as wonderful as the Grand Cañon. The floor is a mosaic of color—green trees, gray sage, salmon-red eroded rocks, and white outcrops of sandstone. Rocks group themselves into cities with castles and towers, which the imagination peoples with busy throngs.

As we went down the steep road into the cañon, we wound in and out among the masses of rock, and crossed arroyos one after another until the cañon walls



Every turn in the cañon brings fresh surprises—a group of ruins appearing suddenly in the cliff or a cluster of trees rising from the stream bed. Salmon-red, the prevailing color of the cliffs, contrasts with silver gray deepening to black where the falling water makes long streaks on the surface



While the Cañon de Chelly is not so imposing and awe-inspiring as the Grand Cañon, in some respects it is even more interesting. At the point under the great overhanging cliff where our camp was situated, the cañon is a quarter of a mile wide, although at the next bend of the river it narrows to a couple of hundred yards



CEREMONIAL GATHERINGS OF THE NAVAHO

Annual dances are the great social occasions of Indian life. From miles around participants and spectators gather for these ceremonies, which sometimes extend over two or three weeks. The dance costume in the Navaho country is along fairly definite lines, but some latitude is allowed in the way of kilts, which are usually made of variously colored velvet ornamented according to the wearer's fancy

leveled themselves into the great Chin Lee Valley. This is one of the most remarkable valleys of the region, because of its tremendous size; it measures about twenty miles across, and ends in a great ridge of black mountains. After skirting the edge of the mesa for twenty miles, we were at Chin Lee, the school and trading post at the mouth of the cañon. Familiar pictures of the Cañon de Chelly lead one to expect it to have an abrupt beginning with high walls at the edge of the mesa; on the contrary, the guide pointed out the cañon mouth to us with difficulty, and at this point its walls are no more lofty than those that bound an ordinary arroyo.

The cañon is more or less dangerous for an automobile when there is plenty of water, although the sand is hard and the road good, because of the quicksand; and it is almost impossible when the sand is dry. Even with an Indian team there is always a certain amount of danger because of the possible sudden rise of the rivers, caused by rains. Rain may come above in the cañon without one's knowledge, and the first intimation that water is rushing down in the dry river bed is a sound like the rattling of hundreds of wind-whipped papers. There is nothing to do but pull on to high ground and stay there for a couple of hours until the water recedes. It is likely to flow for only a short time, although in great volume, not at all like the ordinary swift stream, but in long rolling waves four feet high, with power to drown the horses and carry the wagon and men along to be lost finally in the quicksands.

As the traveler proceeds through the Cañon de Chelly the walls at right and left rise rapidly until at about one mile from the mouth they attain a height of two hundred feet. Almost every turn on the winding floor discloses ancient dwellings high in the cliffs and of the same color, in some places groups of standing houses, in others merely ruin

walls. Small cañons extending back from de Chelly disclose vistas of present day Navaho homes, set in green fields, with melon patches and peach trees. One may travel up the cañon long distances without seeing an Indian, but he may be sure that many Indians, even miles beyond, know of his presence, and that many curious eyes follow his progress.

The Cañon del Muerto branches off toward the left within a mile of the prehistoric ruin known as the "White House," which is perhaps the best preserved and most widely known cliff dwelling of the locality. The cañon wall at the White House is about six hundred feet high, and the White House is recessed in a cave, having the appearance of two white teeth in a wide mouth. The ruin is without ladders and inaccessible now, and is thus protected against vandals.

Thirty feet beneath the White House ruin stands another, built on the river bank; and still below this, set in the bank, is disclosed a third ruin where, within the year, the rush of water in the rainy season has washed away the sand. The presence of this lowest ruin is of great archaeological interest, and a few hundred dollars spent in temporary work would preserve the walls in place. If this be not done, another season's rain will probably wash the whole lower ruin away. When facilities for travel are better, thousands of people will go to cañons de Chelly and del Muerto and find them more interesting than the Grand Cañon itself. One's impression of the Grand Cañon is of a tremendous spectacle, awe-inspiring and impersonal. The Cañon de Chelly, while large, is more intimate. One can touch its walls and feel that he is a part of it. Every turn brings surprises, a group of ruins in the cliffs, trees rising from the bed of the river. The sun casts shadows over the walls on one side, and paints the opposite in orange, except in places where water flows down over the

rock leaving long streaks of silver-gray deepening to black.

We had planned to make our camp in front of the White House and had progressed a considerable distance up the cañon, when a threatened storm arrived. Suddenly, in turning an angle, the rain was upon us. We had just time to pull the wagon sheets around us and cover our camping outfit when the torrential downpour struck, driving almost horizontally and with great force. In ten minutes, however, the sky was clear, and we were on our way again.

We finally reached our camping ground, and pitched our tent under a six hundred foot cliff with a great overhang, where, should it rain, the water would drip fifty feet in front of us. Our camp was placed, as we had planned, almost opposite the White House ruins. At the next bend of the river the cañon narrowed to a couple of hundred yards, but at this point it was very wide, and although the opposite wall seemed only a few yards away, it was actually a quarter of a mile distant.

The first afternoon was taken up in studying the character of the cañon and in looking for locations from which to sketch. The next day I rigged my canvas and started my work under favorable light conditions, but before two hours had elapsed the sun was obscured and rain began to fall. All during the morning, even with my canvas anchored to the ground, it was necessary to hold the stretcher with my left hand while painting with the right. There were several heavy showers during the afternoon so that I had to keep my paint box covered. Trying to use oil paint mixed with rain was very much like pushing water around on a dusty floor. The next morning brought the same conditions, with occasional bursts of sunlight through the clouds, and with stronger winds than the day before. The finished sketch was so large that it would not go into the tent at night, so I had to lay it outside on the guy ropes.

This proved its ruin. We had pitched the tent at the end of a long sand bar with the opening away from the prevailing winds, and during the evening a heavy storm came up from the opposite and unexpected direction and deposited a coat of sand over the wet paint. Fortunately, however, the knowledge gained in transferring the image and coloring of the cañon to the ill-fated canvas survived, and the last day was spent in making pencil sketches and notes on color.

That evening at dusk two Navaho boys appeared at the rim of the cañon and started down, resting on a ledge near the top. We could see that they were carrying heavy sacks, so we watched their progress downward. At one place the wall is so steep that shallow steps have been cut in the rock for a distance of at least sixty feet. Down these steps, with their faces toward the wall and each carrying a two-bushel sack of piñon nuts, they descended with ease and agility. It was a remarkable feat of mountain climbing and when they came into camp we gave them coffee and tobacco and complimented them on their skill. With as much sign language as we could muster we engaged them to carry a note to the trader at Chin Lee asking for a team to take us out. So well did they fulfill their mission that in the afternoon of the next day we broke camp, and arrived at the trading post in time for supper.

Persons who have not been in this wild and little known Navaho country are afraid that there is danger from the Indians, or that the water is bad, or that they will encounter numberless difficulties and dangers. As a matter of fact, the Indians are as friendly as one will let them be, and the dangers and difficulties are not as great as those encountered in the streets of a large city. Indeed, our most thrilling adventure was risking our health by partaking of the products of our own inexperienced camp cooking.



Great Lake, in Craven county, North Carolina, was the haunt of the largest alligator I ever saw in a wild state, and he may still be enjoying his ripe old age there in spite of many attempts to capture him

Alligators I Have Known

By H. H. BRIMLEY

Curator of the North Carolina State Museum

TO ONE who has associated with alligators on more or less friendly terms for any length of time, certain incidents connected with the association stand out prominently. And the record of a few of these may convey possibly a better idea of the animal in its native haunts than more general statements would. Among those I have known, perhaps the strongest mental impression was made by "Grandpa," the largest alligator I ever saw in a wild state. "And how large was he?" you ask. I do not know, as he is still enjoying, to the best of my knowledge, his ripe old age in Great Lake, Craven County, North Carolina.

The first time I saw "Grandpa," I had followed a seven or eight-footer in shore, shooting at its head—although unsuccessfully as to result—every time it came to the surface. While it slowly and unconcernedly made its way into a small indentation of the wooded shores, there showed up the head of the largest

alligator I have ever seen, or ever hope to see—the "Old He One" I had so long wanted for our North Carolina Museum. We followed him into the little bay. I shot at something that in the shadows loomed up like the head of a sixteen-footer (but which later proved to be a cypress root), there was a flurry of water, a huge, scaly back showed for a moment in the shallows—and that was the last I saw of "Grandpa" that summer.

He was—and I hope still is—a wise old bird. In subsequent years he robbed my nets that were set for fish specimens, tearing them up scandalously. I once set for a neighbor a hundred yard net for "eating" fish. This, "Grandpa" took off the cork line for two thirds of its length, and I saw his great, rugged head moving slowly away out in the lake, while I was examining the torn-up net.

I have set baited lines for him, with a whole cormorant lashed on the big

hook for bait. He got the cormorant every time, stripping the hook clean of both bait and lashing, and bending in the point of the heavy shark hook between his powerful jaws until it was useless. He did this to two hooks, in different years, in one instance breaking off the point at the barb. At times I shot at him out in the lake, but the water was always rough enough to keep the boat rocking a little, and never a bullet went home. I did not give him up, but circumstances finally made his home waters unavailable to me.

"Will an alligator ever attack a man?" is the most frequent first question of the uninitiated on reaching the alligator country. The usual answer from those who know is "Never!" In general, the answer seems to be correct. I have, however, mended a canoe that had—while occupied—a hole torn in it by a gator's jaws, I have been bitten by a five-and-a-half-footer, and *almost* bitten by one of seven or eight feet.

The injury to the canoe came about in this way: Two young men were paddling the boat along a narrow ditch through the marsh, when one of the paddles struck a gator either swimming or lying dormant on the bottom. Instantly the animal reached up with open jaws, shut down on the curved body of the boat near the water line about four feet aft of the stem, and ripped the canvas and planking loose over a space about fifteen inches across. The canoe was overturned and the occupants thrown out. One of them found a pole on the marsh, and with that he kept the alligator occupied while his companion ran back to the camp for a rifle. They "collected" the specimen, which proved to be a large one ten feet seven inches in length. They buried the skull near the camp, where I dug it up a couple of months later, bringing it back with me as a specimen for the Museum. This is the largest measured specimen I know of from North Carolina waters in recent years.

Lake Ellis is a body of very shallow water, about two miles in diameter. It is largely marsh, and the open water is thickly dotted with small islands, most of them measuring from ten to twenty feet across. Under the banks of many of these islands the alligators have their burrows, and it is an interesting—and sometimes exciting—business to get them out. A long pole, with a stout steel hook at one end, is the main implement needed, although a spade is often handy if digging has to be resorted to. Naturally, one carries a rifle in addition for the *coup de grâce*.

Sometimes a gator can be teased to a condition of rage that impels it not only to bite the pole but also to hold on to it until the animal's head is drawn clear of the water. On one occasion I had found an owner of one of these burrows at home (one can often tell if the burrow is occupied by the condition of the water and excavated earth at the entrance) and had teased him until the pole was badly chewed. Then, the burrow being unusually large, I lost touch with the animal. I was kneeling in the water and had the eleven foot pole in the burrow to its full length, my arm also being inside the mouth of the hole almost up to my shoulder. About that time something happened! The gator had turned around and had slipped past the end of the pole on his way to the entrance when his snout suddenly grazed my hand. Instantly he grabbed it, and shut down hard, one of the sharp canine teeth penetrating a knuckle joint. Luckily for me he did not hold on, and I got my hand back to safety in short order. The slight wound amounted to nothing, although it caused the most excruciating pain for a few minutes. The incident confirmed me, however, in my desire to secure that specimen—which I did just as soon as the pain in my hand abated. He was about five and one half feet long, with exceptionally sharp teeth.

Experience shows that an alligator,



Lake Ellis is thickly dotted with small islands, under the banks of which alligators have their burrows, and it is exciting business to dislodge them by means of a long pole with a stout steel hook at one end. The three specimens in the foreground, measuring from six and one half to eight and one half feet, were secured in one afternoon



In White Lake large alligators may be found, but their presence does not prevent the negro boys from fishing there or from gathering the water lilies. Alligators construct their nests near shallows teeming with fish

when excited to rage and exertion while in his under-water den, will soon seek the entrance for a breath of fresh air, sometimes slipping away through the



A fish hawk has built his nest in the top of this moss-draped cypress tree in Great Lake

muddied water outside if the entrance is not closely watched. I once had a specimen crawl over my feet while I was standing in the water opposite his hole. It gives one rather a creepy feeling to stand perfectly motionless while an alligator of unknown size and unjudged disposition has one at such short range of jaws and tail. But this one evidently judged my feet and legs to be a part of the landscape and was as gentle with me as I with him.

To sit on the bank above the entrance to an occupied alligator hole, with one foot in the water on each side, and with body bent forward and hands open to grasp the animal's jaws when the tip of the snout slowly and cautiously breaks the surface for a breath of air—gives a rather thrilling period of expectancy. I tried it once, and it worked successfully. The burrow was a comparatively new one, which implies that it was of smaller diameter inside than a longer used one would have been. The moment the tip of the nose appeared at the surface just outside the entrance, and before it had time for the intake of breath that might carry with it the tell-tale scent of danger, I had the animal with both hands, holding his mouth tightly closed. The battle was over: his tail was harmlessly out of the way back in the hole, and his other weapons of offense, his jaws, were out of commission as long as I could hold my grip. This specimen was a little less than eight feet in length.

The largest alligator I ever collected was secured in a somewhat unusual manner. It was in October, and I was wading across Lake Ellis, returning to camp after a long and unsuccessful prowl after deer in the big swamps on the other side. The water in this lake averaged less than a foot in depth, making wading across less tiring than walking around the lake through the heavily timbered swamp.

I was carrying my 7mm Mauser rifle, and I stopped near some holes that usu-

ally contained black bass to see if I could not shoot one for supper. While watching the holes, I saw the head of a large alligator about forty yards away, but it went under before I could shoot. Wading near to the place where it had gone down, I stopped and awaited developments. In a few minutes I saw the gator crawling along the bottom only a few yards away, following the slightly deeper water of what had been the bed of a drainage ditch in years gone by. Coming opposite where I stood, he turned deliberately in my direction until he was headed directly toward me. Whether he saw me and took me for a possible protecting stump, or whether his direct move toward my feet was accidental, I do not know. But I do know that a Mauser bullet stopped his career about three feet from my legs. He was nine and one half feet long, and of the broad-jawed, heavily built type. In this connection I may say that the second largest I ever collected was of the comparatively narrow-jawed, slenderly built, racing type, a very different looking animal from this rugged old mossback.

When alligators were known to me only through the printed and illustrated page, I had the idea that they were usually seen lying sound asleep on the bank or on a log over the water. This does not hold with our North Carolina alligators, however. I have seen a great many in the last ten years but, apart from many half-views of a sliding form that disappeared with a splash coincident with the sight, I have seen only one out of the water that gave me a chance to gaze at it for more than a fraction of a second. This specimen was eight feet four inches in length, as I ascertained later in the day, and I have several articles of outdoor equipment made from his hide. One soon learns, however, to estimate size fairly well from a profile view of the head. The natives of any part of our alligator country almost always can tell of an

individual, "using" up a certain creek, that they know will measure fourteen or



Alligators always stay about the waters near this colony of cormorants. These birds—in this the only colony north of Florida—have nested along the shores of Great Lake for many years. Alligators often catch and swallow the half-grown birds as they swim about under the cypresses

fifteen feet in length. Here is an instance of crudely recorded dimensions: I had shot, and almost certainly killed, a large specimen under conditions of wind and depth of water that made it impossible to secure it, the body sink-

side and estimated its length by the known dimensions of his boat. He reported it as fourteen feet, or more!

In August of the present year, my wife and I spent our vacation at the Onslow Rod and Gun Club, on New



Dim recesses of secluded swamps and bayous, where the trees are festooned with the gray Spanish moss, and a coating of duckweed and green algae covers the water, are favorite haunts of the alligator. Orton Pond harbors many large specimens

ing at the shot. I had a clear profile view of the top of the head from eye to snout, and I feel certain that it varied but a few inches, one way or the other, from nine and one half feet in length. As I learned later, the body floated within a day or two (I had to leave the place before this could occur, or I would have been on the lookout myself) and a passing fisherman ran his skiff along-

River, in southeastern North Carolina. We had some very interesting and familiar experiences with alligators, particularly with small ones, although several of large size were seen. On one occasion, with our canoe lying stationary in a gut deep in the marsh that reeked with alligator sign, we could hear the grunting and splashing of young ones close at hand. We saw

three, evidently of last year's brood, two of them showing up within a few feet of the boat. I tried to catch them with our short-handled landing net, but the coarse stems of the marsh grass interfered with the success of the operation. These alligators we estimated to be from eighteen to twenty inches long.

One day, in another creek tributary to New River, while resting from casting for black bass, we came across several alligators that I judged to be two-year-olds. They appeared (some being clearly viewed at full length) to measure from twenty-four to thirty inches. We followed one about in the open water for several minutes, and I amused myself with casting at him with a buck-tail bait. Finally, I hooked him in the tail, and reeled him alongside the canoe, when my wife slipped the landing net under him. But, a flirt of the tail, and his forepaws on the bow of the net, freed him just in time.

I have examined the stomachs of quite a number of specimens, with some interesting results. The information so gathered would indicate snakes, terrapins, and crawfish as the three chief articles of diet of the alligator in eastern North Carolina, with water birds and fish following. I once took a whole black duck from the stomach of a medium-sized specimen, and I have often found remains of herons, particularly in those frequenting a certain body of water that accommodates a fair-sized nesting colony of egrets and other herons.

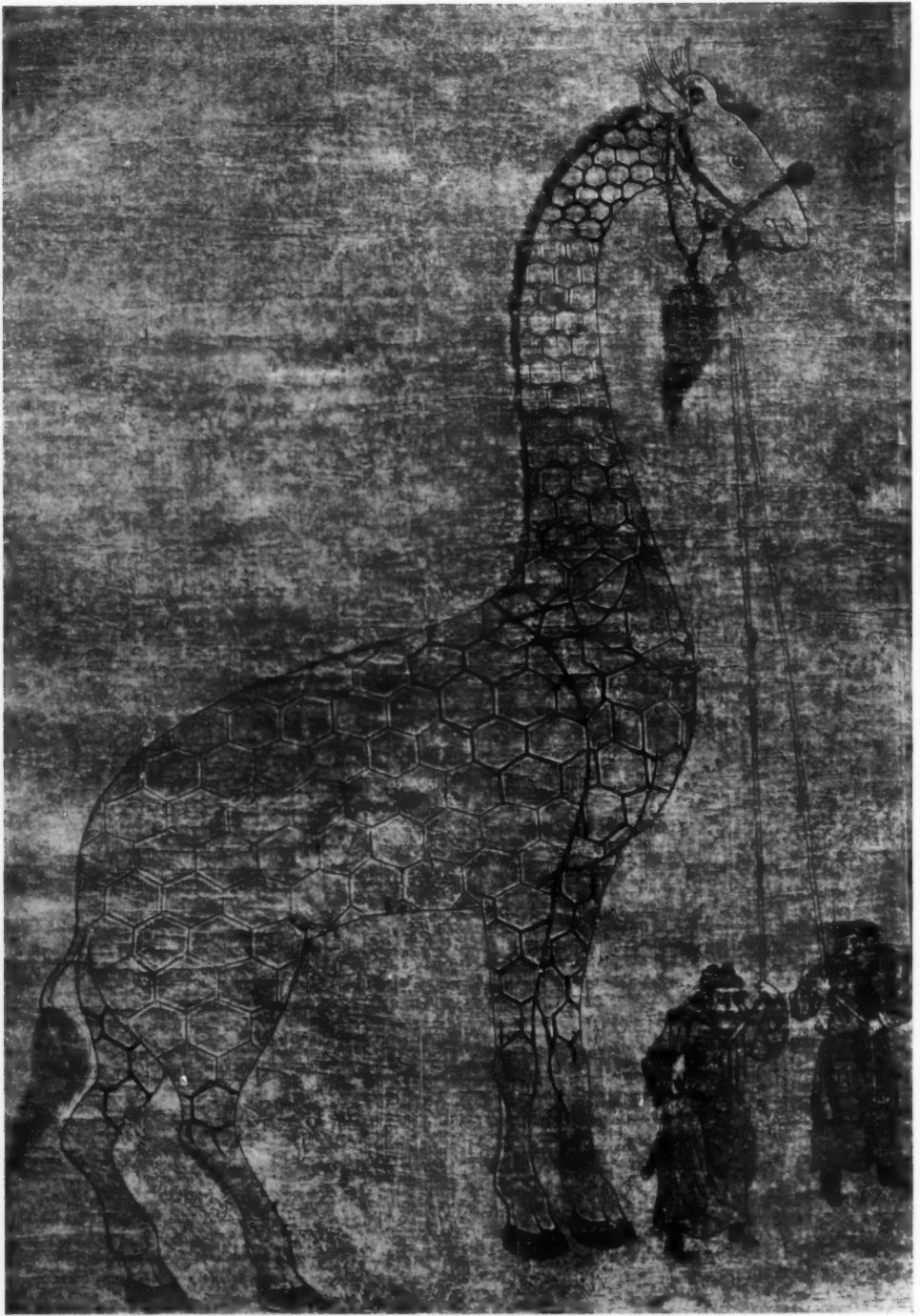
In Great Lake alligators always hang around the colony of Florida cormorants which have nested along its shores for many years, this being the only colony of these birds known north of Florida, I think. I once saw an alligator

catch and swallow—one can hardly use the word "eat" to describe the operation—an almost full-grown young cormorant, while swimming, and I believe that T. Gilbert Pearson, secretary of the National Association of Audubon Societies, had a like experience in the same waters. (I wish I dare tell of the time when Pearson paddled me within shot of a large and fast-swimming alligator, and what he said when I missed it!)

The usual assortment of gravel and pieces of wood almost always is present in the alligator's stomach, and once several pieces of brick were found. From the stomachs of two specimens collected in Lake Ellis, a famous duck-shooting ground on which many thousands of cartridges have been expended, the brass bases of shotgun shells were taken, one stomach containing three and the other four. But I never have found any diamond rings, gold watches, or other articles of intrinsic value.

Fish seem to form but a small part of an alligator's diet: in fact, I remember finding fish remains in the stomachs of only two specimens. One of these contained a grindle (bowfin, *Amia calva*), and the partly digested remains in the other indicated a sucker of some kind.

On one occasion I was coming out to civilization from a surf-fishing trip to Topsail Inlet when the information of the killing of a *crocodile* was given to me. "Yes, sir, it sure was a crocodile, 'cause its upper jaw worked," the "working" of the upper or lower jaw identifying the animal as a crocodile or an alligator, according to local legend. And I had some difficulty in convincing my fishermen friends that their "crocodile" could not have been other than our old friend, *Alligator mississippiensis*.



ANTIQUE PAINTING OF GIRAFFE

The original of this ancient Chinese drawing, which dates probably from the early Ming period, is a large unsigned painting in dull colors on silk. The general style of the painting, as well as the state of preservation of the fabric and coloring, would seem to indicate an antiquity of at least three or four hundred years

Giraffe and Sea Horse in Ancient Art

By CHARLES R. EASTMAN

FIGURES of ancient Egyptian and also of late fifteenth century representations of the giraffe were published in several numbers of *Nature* for 1915, and also in the *AMERICAN MUSEUM JOURNAL* for the same year. To this series of old-time drawings may now be added one from Chinese sources, dating probably from the early Ming period.

The original is a large unsigned painting in dull colors on silk, executed with considerable firmness of style and finish, the tracings and figures of the attendants having received especial attention. The general style of the painting and the state of preservation of the fabric and coloring would seem to indicate an antiquity of at least three or four hundred years. In the opinion of the owner, a dealer in Chinese works of art in New York, Mr. A. W. Bahr, the painting is even older.

Through the kindness of Miss Greene, in charge of the private library of Mr. J. P. Morgan, of New York City, the writer has had the privilege of examining a number of old manuscripts containing animal paintings, among them being one which is probably the earliest known English bestiary, dated 1170. Another is an extremely interesting Persian bestiary of the thirteenth century, which has been briefly noticed by M. Claude Anet in the *Burlington Magazine* for 1913 (Vol. XXIII, No. 24). Among the admirably drawn colored figures of this Persian manuscript is one of the giraffe, which is strikingly like the Chinese painting already referred to. One can hardly escape the conclusion, on comparing the two pictures, that one has served as a model or general design for the other, and undoubtedly the Persian is the more ancient. The inference appears warranted, therefore, that illustrations of the giraffe and other western animals were introduced into Persia through trade routes as early as the thirteenth century, and thence found their way into China, where they were copied by native artists.

The earliest printed figure of the giraffe appears in the first edition (1486) of the *Iter Palæstinum*, by Bernard de Breydenbach, who traveled in Persia and Arabia

during 1482 and the following years. This representation is much less accurately done than the early paintings. The proportions are less true to life, and the animal's head is much like that of a goat, with its beard and rather long horns. The markings intended to show color patches, instead of being laid on in more or less regular hexagonal patterns, as in the case of the two earlier ones, are indicated by irregular dots. The figure, a small one, appears on the same page with those of a crocodile, an ape, a camel, a salamander, and two goats, all, according to the author's statement, faithfully depicted as he saw them in the Holy Land.

Reproductions of early figures of the common Mediterranean species of sea horse (*Hippocampus*) have been published by Prof. Raymond Osburn in the *Zoölogical Bulletin* for March, 1915, and also by the present writer in the *Annual Report of the Smithsonian Institution* for the same year.

It is remarked in the latter of these articles that no mention is found in Aristotle of this striking form of fish life, and the term *Hippocampus* was used by the poets of classical antiquity as the name of a sea monster, half horse and half fish, on which sea divinities rode. Nevertheless, the design of the sea horse occurs not infrequently in the plastic arts of Hellenistic civilization, both in Greece and in Italy. The sea horse is figured occasionally also among the island gems, as stated by Fürtwangler, who figures one of them (*Antike Gemmen*, Vol. I, Pl. V).

Figures of animals, including fishes, represented in ancient Grecian vase paintings, have been made the subject of special study by a young French artist, Morin-Jean,¹ and a compatriot of his, P. H. Boussac, has written interesting articles on fish designs inscribed in ancient Egyptian monuments.²

Only one instance is known where the *Hippocampus* is depicted in ancient works of art from the Nile Valley. The design referred to forms part of a decorative painting

¹ Le dessin des animaux en Grèce, d'après les vases peints. Paris, 1911, p. 262.

² Les poissons sur les monuments pharaoniques. *Le Naturaliste*, Vols. XXXI and XXXII, 1909-10.

in the interior of a mummy case dating from the twenty-sixth dynasty (700-500 B.C.), now preserved in the City Museum of Gloucester. A brief description of it is given in Vol. II (1911), of the *Historical Studies* published by the British School of Archaeology in Egypt, and this is accompanied by a photograph of the original, which has been copied in the annexed figure.

Certain of the details are thus indicated in the description just referred to: "The

greater part of the *Hippocampus* is outlined in black on the white ground of the coffin; the ears, the eyes, the nostril and the mane [i.e., conventionalized dorsal fin] are indicated in black; round the jaw is a wide black band edged with yellow; the muzzle is yellow with black dots; the wide horizontal stripes on the neck are alternately blue and red edged with black. . . . The date of the coffin accords well with the period of the archaic Athenian pediments."



Decorative painting of the *Hippocampus*, from the interior of an Egyptian mummy case dating from the twenty-sixth dynasty (700-500 B.C.), now preserved in the City Museum of Gloucester

The New Natural History—Ecology

By CHARLES C. ADAMS

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THE study of the natural history of animals always has interested observing and thoughtful men who know nature at first hand. The degree of health and sanity shown in zoölogy can be measured accurately by the amount of interest taken in this sort of animal study and the respect and encouragement shown it.

The Old and the New

The older naturalists were interested mainly in the activities of living animals, especially those in the wild state. These men were usually what might be called "spontaneous naturalists"; they were largely self-trained, that is, they were introduced to animals for the first time not in schools or in museums but by direct contact with them as they tramped the fields and woods or while hunting or fishing. With the rise of modern laboratory instruction and research, and with the accumulation of larger collections in museums, another type of naturalist developed, the "closet naturalist." He was busy with laboratory studies in physiology, anatomy, development, behavior, and taxonomy. Here fragments of animals, biochemical problems, experiments on animals in "unnatural" controlled conditions, and the "skins and skulls" of the taxonomist were the objects of his study. This gave us a period of analysis, which has resulted in very important advances. The field naturalist was frequently only a collector, often an amateur taxonomist who did not take to the sedentary life, or one who dared to keep up his interest in live wild animals in spite of the prevailing fashion for other lines. With this specialization there developed class feelings; often the individuals of each class were inclined to feel that their group only was concerned with "fundamental" problems, and that the others perhaps might be "all right" personally, but unfortunately were on the wrong trail! The closet student often felt that he only was doing the careful "permanent" (is there such?) scientific work, while the field worker was superficial and untrained, and therefore his results were of

little value. The field worker was also often inclined to look upon his closet friend as one who devoted his time to trifles, as one who talked much and loudly of evolution, and yet had no real first-hand experience with the conditions in nature which most animals must endure. This has been the status now for nearly a generation.

During the last ten years, however, a marked change has become more and more evident. Some of the older dominating ideals of the laboratories and museums are now in the background. Public interest has asserted itself; some of the zoölogical fashions have changed to new ones; economic problems have become more prominent; some of the older dominating men with the older ideals are losing influence as leaders; some universities which at first would not endure the newer ideas of work, later tolerated, and finally encouraged them. Thus a greater variety and a broader outlook have resulted. A student is now permitted to study, in addition to anatomy and histology (which crowded aside taxonomy for a time), taxonomy, physiology, behavior, heredity, ecology, and even the application of these to human affairs. This development has not been symmetrical, but it has become vastly more varied, and permanently so, it is to be hoped.

The museums have undergone changes similar to those of the universities, because the ideals both as to study collections and as to the exhibits have changed. The "habitat" groups, particularly, show this, as well as the character of the members of the museum staff, who as a class have a much broader training. With this general liberalizing of our universities and museums the student and the public are getting a broader idea of animals in the economy of nature and of their relation to man.

Disadvantages of the Old

One of the unfortunate results which attended this period of discouragement of natural history in our universities, museums, and schools, was that many persons who already had developed an interest in live ani-

mals were repelled, and even driven from this field of activity, some temporarily and others permanently, by the narrowness of their leaders and instructors. Almost every teacher interested in the natural history side of zoölogy can recall such examples. It has been this same sort of spirit which has made many professional naturalists view with disfavor or contempt the activities and interests of amateurs. For this reason, interest in the study of live animals is felt by many persons who are out of touch with naturalists, although in a large number of cases there would be mutual benefit and respect, if points of contact and sympathy were established. Animals are a factor in a large number of our outdoor sports, among whose devotees there are many men who take a very sane and intelligent interest in fish, game, and bird life, but usually these persons get little benefit from the professional naturalist. Each goes his way independently, to the disadvantage of both; the professional ignoring the valuable results of the amateur, and the amateur unaware of the results of the professional. *

In a democracy, where we look upon science as a tool to aid us in securing better human living in the broadest and best sense and not simply as a toy for a leisure class, it is obligatory that there should be widespread benefit from animals, if we are to expect intelligent public opinion to support the study of natural history as it deserves. It is coming to be recognized that there has been serious negligence on the part of many leading zoölogists in supporting the various activities intended to conserve fish, game, birds, and other wild animals. As a result there has been a tendency to allow this kind of work to fall into the hands of persons whose enthusiasm for protection, or selfish love of sport, is not always balanced by a sane and expert knowledge of live animals. Naturally grave errors have been made, and will continue to be made until additional leaders of the right kind are secured, and until naturalists come to realize that the application of ecology to these problems is the only safe basis for action.

Advantages of the New

There is now coming into control of zoölogical interests a new generation which has been trained, not only in all of the older

established methods, but also in the newest, bringing into modern natural history from every direction the training, methods, facts, and ideals of diverse fields. As previously stated, the older natural history was devoted mainly to the study of life histories and habits, but the more recent work not only has continued this excellent feature, but in addition has supplemented it by the best laboratory methods. The new natural history, therefore, is working on a higher level, with a broader outlook, and has a saner and closer contact with nature than was possible by either the laboratory or the older field method alone. It takes the laboratory problems into the field and brings the field problems into the laboratory as never before. This newer natural history of animals is now usually defined as the study of the relation (causal) of the animal to its complete environment. It is to the activities, or responses to the environment (including plants and animals), that primary attention is given. All kinds of facts which throw light upon what animals do are thus recognized as of ecological value. In the comprehensiveness of ecology lies its strength—and its weakness, in the opinion of some. To some minds it is too general, indefinite, and hazy. It includes so much, that some are confused and discouraged. To others, who delight in the outdoor study of animals, who desire a broad comprehensive outlook, who demand room for imaginative play, and who will not allow arbitrary boundaries of their field to interfere when they seek an explanation of animal activities, the new ecology is very inviting and its pursuit fascinating.

We have now sketched in the background for the new natural history. It is generally venturesome to call anything new, because again and again history has compelled us to revise our opinions on this point. It seems safe, however, to say that ecology is new not only in its recent clear-cut conception of its field and in its multiple method of attack, but also in the kind of facts and ideas discovered by the newer methods. Progress takes place by the discovery of new facts and new ideas, and of the two, new ideas are the more difficult to get. Ideas give new points of view, lead to the reorganization of the old, and stimulate the discovery of many new facts. It is not sufficient, therefore, that the public should know ecological facts only; it must have a

similar knowledge as well of ecological ideas, ideals, and principles in order to get the best results from this line of work.

At the present time, perhaps the main scientific value of the ecological standpoint is in its marked synthetic tendency. A vast number of isolated facts, ideas, and even principles, have drifted about, or have lived isolated lives, pigeon-holed in some of the allied sciences, but have not been known or fully utilized in zoölogy. Various physical sciences, with their refined methods, have made important discoveries in ideas of dynamics which are of the greatest value in animal study. The same is true of certain similar conceptions in geology, physiography, meteorology, geography, and plant ecology. In all these fields the active or dynamic phases have made great strides, and often with more clearness and intelligence than in zoölogy. From geology arrives a time perspective secured from no other source; from physiography, geography, and meteorology come ideas of the gross physical processes which furnish the only proper background for understanding chemical and physiological processes and stimuli which influence animals. The ultimate dependence of animals upon plants for food, and the indirect influence of vegetation upon the environment, are a revelation to the old school naturalists when presented to them in modern form. The laboratory contributes in a similar manner from physics, chemistry, biochemistry, physiology, and studies of behavior; and finally, ecology acts as a focusing lens which converges light from all the sciences upon its own and allied economic problems. We must remember that the economics of man is a phase of human ecology. In the synthetical relational tendency of ecology the dynamic conceptions from the allied sciences flow naturally into zoölogy when animals are properly related to their whole environment. In this manner ecology is enriched and invigorated by support coming direct from the most recent conceptions of the sciences fundamental to it.

Ecology and Human Economics

The economic problems relating animals to man have been, and are today, largely handled by the rule of thumb, although there are some striking exceptions. The reason for this is probably the fact that practice is

generally in advance of the scientific explanation. In application we are yet at work on the scientific foundations; the structure itself stands, in part, upon a temporary or "frame" support. Never will the time arrive when action always can be delayed until we have a full scientific information, and yet such must remain our ideal.

Many of the animal problems are attacked without regard to their being ecological in nature, and often without benefiting from progress already made in ecology. In spite of this disadvantage, important progress is made, although at a high cost, and we are reminded constantly that better work could have been done with the same effort had these workers utilized completely the results already obtained.

Good examples of practical ecological problems are those which deal with the relation of animals to disease, and to the production of animal crops from the fields, forests, and waters, both marine and fresh. The ecological character of many agricultural problems is realized only slightly by many of its leaders; the ecological character of aquatic problems is realized probably more clearly, but in practice it lags far behind agriculture; while the ecological understanding of animal crops from forest lands and waters—and of game in general—is only beginning to be realized in this country. The intelligent management of the animal life of our national parks and all animal preserves is dependent upon our knowledge of the ecology of these animals; and we shall succeed in their proper care and use in proportion to our mastery of their ecology and its applications.

The Future: World Leadership

The remarkably rapid rise of ecological work in America is one of the most significant recent advances of science in this country. Plant and animal ecology probably receive more attention from American universities and museums than from those of all other countries combined. The botanical side has perhaps grown more rapidly than the zoölogical, at least consciously. Since 1902, when at the University of Chicago the writer gave the first university course in general animal ecology, with lectures, laboratory and field work, this kind of study has grown up in many universities, and has become permanently established. Looking back over

this period one can see many changes in men and institutions with regard to this subject. In some cases men who were at first hostile to any disturbance of the orthodox courses (which largely ignored ecological relations), have mellowed with time; others who were agnostics, and wished to be shown that ecology was worth while—was a real subject and not merely a name—have since been convinced; many indifferent ones have felt obliged to become interested and informed; while the younger generation accepts the subject as a matter of course, in the same way as it does physiology or anatomy. Before many years we may expect similar changes in secondary instruction, because without doubt modern ecology includes, both in subject matter and in method, the materials which are of the greatest interest to young students, and are not surpassed educationally by any other aspect of zoölogy. And in case schooling is limited, ecology contains a greater amount of valuable subject matter than any other phase of zoölogy, because it is more closely connected with human economic problems.

A striking indication of the healthy growth of ecology is seen in the successful development of the "Ecological Society of America." In 1914, the agitation for an organization began to take shape on a provincial scale, but this rapidly grew to national proportions, and finally took definite form as an international organization. In the recently published list (1917) there are names of more than three hundred members who are willing to be called ecologists, persons who are interested or working in ecology. This does not mean, of course, that there are that many professional or trained ecological investigators. If, however, Prof. J. McK. Cattell's criterion of the amateur, "A man must be regarded as an amateur in work to which he does not devote more than half his time," be applied, only a relatively small number of these persons are professional ecologists, although many of them are professionals in allied sciences. They are, nevertheless, a very representative body of American scientific workers. In number, the plant and animal ecologists are rather equally divided, the subjects in which greatest interest is shown being plant ecology and forestry, and animal ecology and entomology. There is in the world no other similar large body of experienced ecological

workers. Such an outlook is certainly favorable for the future development of ecology in America, and of its applications to human problems. It is hardly necessary to remark that numbers alone are not decisive in the progress of science, but numbers and able men are decisive, and the ecological society has both of these.

Can this growth of ecology in America be merely accidental, or is it a result of our newness and our freedom from tradition, or has it an even greater significance? Can it possibly be another indication of intellectual leadership which for some time has been developing in America? A botanical friend informs me, as a result of his European travels made before the present war began, that eminent Dutch and German botanists expressed their opinion that scientific botanical leadership was passing from Europe to America. Such a statement is startling to those who have been accustomed to hear and to see American science slighted or ignored by European students. In Europe, ecological leadership has long been with Denmark, whose botanists, as well as students of marine and fresh-water animals, have been the model for all other countries. Our leading universities have been developing an excellent blend or combination of the best teaching and research ideals and methods from Europe, a fact which speaks well for the training of future ecologists. The wonderful progress made by American students of heredity already has become prophetic of what may be expected, with proper encouragement, from other branches of zoölogy. Financial, economic, and democratic leadership already have followed the course of the "Mayflower" and with such a foundation there should be, corresponding to these obligations and opportunities, scientific leadership in America.

If ecologists are equal to the occasion and see the strategic and critical period now impending, they may be able to gain an advantage for ecology which previously has not been accorded it, and which its merits deserve. There are evidences in several other lines of activity which appear to harmonize with the preceding suggestions. The important feature at the present time is alertness as to opportunities and obligations, with a desire to do whatever is best to advance a subject of so much interest and of such general usefulness.

Age-Societies of the Plains Indians

By ROBERT H. LOWIE

Since 1899, when Dr. A. L. Kroeber, now of the University of California, began his researches among the Arapaho, the department of anthropology of the American Museum has been almost continuously engaged in an investigation of Plains Indian organizations. Under the curatorship of Dr. Clark Wissler the field was parceled out among different members of the staff, Dr. Wissler himself devoting his attention to the Oglala, the Blackfoot and the Pawnee (the last with the aid of Mr. James A. Murie, a chief of the tribe), while to Mr. Alanson Skinner were allotted the Plains Ojibwa and several Southern Siouan tribes, to Dr. Pliny E. Goddard the Sarcee, and to the present writer more particularly the Crow, Hidatsa and Mandan, as well as a number of other tribes imperfectly known in this particular respect. After years of labor this work has now drawn to a conclusion and the final paper of a thousand-page volume is being issued under the title *Plains Indian Age-Societies: Historical and Comparative Summary*. Some of the more general results may be of more than merely technical interest.—THE AUTHOR

AGE-SOCIETIES occur, strictly speaking, among only five of the Plains tribes, the Hidatsa, Mandan, Blackfoot, Arapaho, and Gros Ventre, and the system of the first-named may be taken as typical. Among the Hidatsa the entire male population was divided into about ten societies, each composed of men or boys of about the same age. An individual did not belong to a society automatically by virtue of his years, however; rather was he obliged to buy membership in company with his age-mates. Thus, young boys of, say, ten would not form any organization, but as they grew up would come to covet membership in the lowest grade, the Stone Hammer Society, then held by their immediate seniors. That is, they desired to possess the privilege of performing a certain dance, of wearing the distinctive regalia of the organization, and exercising whatever other prerogatives were bound up with the native notions concerning the Stone Hammers. In order to consummate their wishes, they dispatched gifts to the older boys, whom they humbly addressed as "fathers," and these attempted to fix as high a purchasing price as they were able to extort. For possibly ten or even twenty nights the members of the younger group were obliged to feast the sellers and give presents of blankets and horses, and when the older group had made the requisite paraphernalia and conveyed necessary instructions to the buyers, the purchase was considered complete. The younger boys then paraded about the village with their newly acquired badges and performed the newly learned dance, while the "fathers" merely acted as musicians—and thereafter had no more rights to Stone Hammer membership. It was now the turn of the older boys to purchase entrance into the next grade by going through essentially the same rigmarole, and so on throughout the entire scheme of organizations.

One problem in particular aroused the interest of students in connection with this institution. What is the relation of the age factor to purchase? Organizations founded

purely on age would not involve any entrance fee; on the other hand, if the purchase were essential, why were fellow-members always of the same age? It would seem plausible that on that assumption a well-to-do youth might rapidly acquire one membership after another until he had attained to the highest rank. This puzzle becomes all the more pressing when we find that the organizations graded by age among the five peoples mentioned occur among other Plains tribes without any grading or age qualification, but that the purchase occurs only with the age factor, although it would seem that these two elements were mutually contradictory.

One of the first points that became clear as the investigation progressed was that any particular society was not essentially connected with a particular age even though all the members were age-mates. That is to say, it appeared that while, say, in 1840 all the individuals in the Dog Society were forty-five years old, in 1860 they may have averaged sixty in the same tribe, and perhaps only thirty elsewhere. The astonishing fact also came to light, that one and the same group might simultaneously hold several memberships. In 1910 an old Hidatsa informant still considered himself a member of a society he had joined at seven, of another he had entered at twenty, of a third he had joined at twenty-seven, and of a fourth he had purchased at about forty-five. Similar statements were obtained from other witnesses, and they were uniformly accompanied by the explanation that a man had a right to every society he had ever bought which for some reason he had never sold. This seemed to establish definitely the predominance of the purchase notion. If the societies had any direct relation with age, it was absurd to assume that a group or individual could be simultaneously connected with several groups.

Nevertheless this could not be the whole story, since the age of all the members of a society at a particular period was practically uniform in spite of the variations in age

permissible for one and the same organization at different times. The whole matter is cleared up only when we understand the mode of purchase, which is collective rather than individual. A group of young boys playing together and forming approximately an age-group are constituted into a definite body by jointly passing through the initial social experience of buying the lowest grade. By simply continuing together at every successive purchase, they form a permanent union of age-mates, and since all groups follow the same course of action, the association of organizations with bodies of coevals is quite intelligible.

The Plains Indian age-societies are especially interesting because of their analogies to institutions of remote areas, which, however, merely serve to throw into relief the distinctive peculiarities of the American phenomena. Thus, in Melanesia all the men are ranged about a number of fireplaces in a clubhouse, each fire being associated with a distinct grade of the order. Each degree is purchasable and accordingly the series seems comparable to the Hidatsa scheme. Yet it differs fundamentally, because in Melanesia the buying is a purely individual affair, so that most men never advance beyond the middle ranks, while only the especially wealthy and fortunate reach the top. In other words, here there is grading with purchase but no suggestion of age-societies. On the other hand, the Masai of East Africa have age-companies formed during the tribal initiation ceremonies. The principle is really very similar to the Hidatsa one, for here too the organization of a permanent social unit results from a joint social experience. But the nature of that experience is very different from that of the Hidatsa, and more particularly, there is no trace of the element of purchase which figures so largely among the North American Indians. In short, there is merely analogy not homology and the Plains Indian age-societies remain an institution *sui generis*.

The data collected on the Plains Indian age-organizations have a direct bearing on certain sociological theories that have figured prominently in ethnological literature. The late Dr. Heinrich Schurtz, of Bremen, assumed that community of age was the earliest bond that united men into definite societies and that all other forms of organization, such as societies based on religious motives, came later in human evolution. At the same time he conceived the early division of male society to be according to three distinct groups, such as boys, married men, and old men. This was a very plausible assumption since such a rough classification

might be made even in primitive times, while a more minute division would seem improbable with people who do not reckon their ages by years. The Hidatsa phenomena show that refined classification is quite possible at a primitive level. All that is needed is that a group of boys should be consolidated by jointly acquiring a certain status and that this practice should become fixed for succeeding groups of boys. Then the total number of companies in a given tribe will simply depend on the number of groups which have passed through the initial experience. Among the Plains Indians the permanence of the bond is emphasized by the fact that the same group of individuals which purchased the Stone Hammer membership will later buy the Kit Fox, Dog, and all other organizations. But this is not essential, since the Masai have permanent age classes with definite privileges but only a single social experience, the initiation ceremony, through which all tribesmen have to pass. The indispensable thing is thus merely that the first welding together should establish a permanent bond of union.

We can, therefore, understand how as many as ten or more age-groups could readily develop in a tribe without any conscious subdivision of the whole population. It is also plain that age plays an important part, since it is the bond that unites the boys before they collectively acquire the status of the lowest grade. Among the Plains Indians, the factor that unites individuals into a group is really age, as Dr. Schurtz contended, but the factor that determined that the group so constituted should become the possessor of certain ceremonial and social prerogatives, was purchase.

A very important problem is whether the age-grading is the earliest bond of organizations in human society. The Plains Indian phenomena definitely contravene this hypothesis. While it is true that some of the organizations seem to have originated among the tribes with graded schemes, other societies certainly developed elsewhere and were secondarily united with the age series. There can be no doubt that in some instances admission is based on purely social considerations regardless of years, while in others a certain form of religious experience shared by a group of men constitutes the sole bond of union. In short, age is certainly a real force in the evolution of tribal societies, but it is far from being the only socializing factor and there is no reason to think that it preceded all others, least of all, in North America, where organizations not based on age far outnumber those that are.

Two Fur Seal Problems and Their Solution¹

By GEORGE ARCHIBALD CLARK

Academic Secretary of Stanford University

A PROPERLY informed breeder of cattle would know the ultimate or average age which his breeding stock might be expected to attain, and the annual increment of young breeders. Such knowledge would be considered fundamental to successful breeding of any of our domestic animals.

The United States Government is engaged in the breeding of fur seals on the Pribilof Islands in Bering Sea, and has been for fifty years, but has not yet definitely ascertained these two important facts with regard to its seal herd; and until five years ago no real progress was made toward ascertaining them. When we consider the amount of investigation to which the seal herd has been subjected in the last twenty-five years, this seems an incredible statement, but the explanation is simple—no investigator has ever been allowed opportunity to study the herd for more than two seasons in succession, and to solve the first of these problems would require at least fifteen years of close, systematic study. The solution of the second problem is dependent upon the first and has, in addition, elements of its own which have required five seasons to solve.

These problems are not so simple in the case of seals as in that of domestic animals. A cattle man can send out his cowboys and round up his herd at any time; he actually can count the various classes of animals. The fur seals, however, get all their food in the open sea and spend the winter in a long migration far from the reach of man. They can never all be brought together at any one time. The animals do not carry upon themselves any distinctive age markings. The seal which has begun to decline ever so little in strength and efficiency succumbs to the harsh conditions of the northern winter; only those in prime condition and physically fit return in the spring.

The three-year-old females, which constitute the breeding increment, come upon the breeding grounds gradually and mingle with the adult females, being indistinguishable from them. The two-year-old females, hav-

ing no young, are even less recognizable as a class, while the yearlings of both sexes keep to the sea for the most part in the breeding season. The two, three, and four-year-old males, the animals from which the product of the herd is taken, are irregular in their movements. They frequent hauling grounds separate from the areas occupied by the breeding seals. The method of taking the quota is to have these hauling grounds driven each week during a season of from six to eight weeks. Animals of approximately three years of age only are taken; the others are returned to the sea. New three-year-old animals are found each time, and the killing season closes early in August, not because of exhaustion of the supply of killable animals, but because of an undesirable condition of the skins due to shedding. It is not possible, therefore, to determine the number of three-year-olds even by the process of elimination. Naturally no enumeration of the two-year-olds, driven and redriven as they are, can be made. Of the breeding seals, it is possible to make an exact count of the harem masters because of their large size and the fact that they do not change their positions during the breeding season. The breeding females, however, come and go in the sea, and never more than one half of them is present on land at any one time. In short, aside from the breeding males—the smallest element in the herd—there is no direct way of enumerating any class of the grown animals. Fortunately the pups of the season do not take to the water during the first month or six weeks of their lives, and at the close of the breeding season can be driven up and counted. As each breeding female has but one pup the count of pups is equivalent to a count of females, and from this known element of the pups a fair approximation of the other nonbreeding animals can be arrived at.

These problems are not merely difficult in the case of the fur seal; they are unusually important. It is vital to the life of the seal herd that the killing of the males should not be so close as to leave an insufficient reserve

¹ Read before the Western Society of Naturalists, 1917.

for breeding purposes. It should be close enough not to involve waste; sealskins are worth approximately fifty dollars apiece. A determination of the proper breeding reserve naturally requires knowledge as to the breeding life of the male, hence, of the normal life period. To maintain a safe reserve and at the same time to take advantage of the full product of the herd requires a definite knowledge of the number of three-year-old males available in any given season. The information cannot be obtained directly.

The sexes are practically equal at birth and subject to like vicissitudes. It may be assumed that they will survive in equal numbers to the age of three years. This is breeding age with the female. An enumeration of the three-year-old females would give the needed information, but these cannot be enumerated directly. A full count of the pups for two or more successive seasons would give a measure of the herd's normal yearly gain. This annual gain results from the increment of three-year-old females but is not a measure of this increment. The annual loss in adult females through natural termination of life must be added to the normal gain to give the full number of young breeders. To obtain this annual adult loss requires knowledge of the ultimate age of the female. Under the conditions affecting seal life we have no reason to assume that either male or female survives breeding capacity, and the breeding limit and age limit may be considered identical. Thus the various problems affecting intelligent management of the fur seal herd ultimately depend upon the settlement of the question of average age or normal life span.

Fortunately we have certain accidental sidelights on the problem of age. In 1891-2-3, during the *modus vivendi* covering the period of the Paris Tribunal of Arbitration, land sealing was suspended, and a large body of young males was left to grow up in these seasons. These appeared as a conspicuous body of idle bulls in 1896-7 and the years immediately succeeding, outnumbering the active or harem bulls three to one. In 1901-2-3, these idle bulls disappeared as a class so suddenly as to excite alarm lest the killing then in vogue had been too close. A movement for the setting aside of a definite breeding reserve of males resulted. But the disappearance of these idle bulls had nothing to do with killing conditions in the period

in which they disappeared. They came into existence as a class in an abrupt and arbitrary manner; they disappeared as abruptly and arbitrarily. These animals were three years of age at the time of their exemption from killing. They disappeared ten years later, suggesting thirteen years as an approximate average limit in the case of the males.

Again, in 1896 and the years following, an experiment was carried on in the branding of female pups, to depreciate the value of their skins with a view to discouraging pelagic sealing. In the years 1900-1-2, a distinctive form of brand was used, no differentiation being made for the three seasons. A considerable number of these branded females was observed on the breeding grounds in 1909, and again in 1912 and 1913, the number being greatly diminished in 1913. No record of observations on these animals in subsequent years is available to the writer, but the conditions as noted in 1913 pointed to from twelve to fifteen years as the approximate age of the female.

These two incidents in the life of the herd throw valuable light on our problem but do not give exact data. In 1912 a beginning was made toward securing more definite information. The time was favorable because the herd was then at the lowest condition in its history, and was on the point of increase owing to the abolition of pelagic sealing, accomplished the preceding year. All problems connected with the herd were in a condition to be most easily handled. The matter was somewhat urgent, moreover, as the agents of the government and of the former lessees of the fur seal industry were then under investigation on charges of illegal killing of seals, the question turning upon the yearling seals but involving considerations affecting the whole policy of land sealing. These charges were known to be untrue but convincing data were not available for their disproof. They nevertheless had their effect upon Congress, and in 1912 legislation was enacted suspending land sealing for a term of years, although this action involved an annual loss of approximately half a million dollars for five years. The annoyance and discredit to government employees and the financial loss thus entailed were due primarily to lack of adequate information on the two points we have under consideration.

First, as to the annual breeding gain in

the herd: A full count of the pups born in 1912 was accomplished, totaling 81,984. A count was made also in 1913, giving 92,269, a gain of approximately twelve and a half per cent. A third count was made in 1914, but by new investigators, and a gain of only one per cent was found. In 1915 the count was in charge of one of the government agents who found a total of 103,527. Fortunately the same agents had charge of the count for 1916, finding a total of 116,977, a gain of approximately thirteen per cent. We thus have two sets of counts each with the personal equation unchanged, and they give respectively twelve and a half and thirteen per cent for the annual gain in the herd. These may be taken as fixing with reasonable exactness the rate of growth at about thirteen per cent.

Although the settlement of this point must await the ultimate age determination to be useful finally in fixing the number of three-year-old animals, male and female, it has yielded immediately useful information. To count the pups each season as the herd grows is physically impossible, and some form of estimate must be substituted to reach an approximate determination of its condition from year to year. It will be possible always to make a close count of the breeding families. From the five seasons in which the full count of pups has been made, average harem sizes for each individual rookery, for each island separately, and for the herd as a whole, are available which, when finally averaged, can be applied to the count of harems and depended upon at any time to give a close approximation of the size of the herd.

Second, as to the final age limit or life span: In 1912 between five and six thousand fur seal pups were branded on the crown of the head with hot irons, giving a permanent and readily recognizable identification mark. It was expected that from the survivors of this branding a certain number of animals could be killed in 1913, and from very exact animal and skin weights and measurements a standard of the yearling seal obtained. A further killing in 1914 would standardize the two-year-old, in 1915 the three-year-old, and in 1916 the four-year-old. Continued observation of the remaining branded animals on the breeding grounds, season by season until their final disappearance, was then

expected to fix within reasonable limits the ultimate or average age.

The standardization of the yearlings was interfered with in 1913 by the fact that these animals did not appear on the hauling grounds in the breeding and killing season. Incidentally this disproved the charge that yearling seals had been killed, since, if they do not come to the hauling grounds in the killing season, they could not have been killed as alleged. They did appear late in the fall among the pups of the season, their natural affinities.

It is understood that enough of the branded animals were killed in 1914 to fix the standard of the two-year-olds. It may be presumed that similar data were obtained in 1915 and 1916 for the three and four-year-olds. Whether the close and painstaking observations necessary during the next ten or twelve years to determine the final disappearance of the branded animals will be made remains to be seen. The shifting personnel of government agents, already fully occupied with routine duties of administration, is not a hopeful source from which to expect satisfactory results. If such observations are not available, the whole experiment looking to a determination of the age limit fails and will have to be begun over again.

The need of reliable data regarding the fur seal herd in these respects is one long felt by those who at intervals have studied briefly its problems. The Fur Seal Commission of 1896-7 considered the matter of sufficient importance to urge, as its one paramount recommendation, that a competent naturalist be placed in charge of the herd who should make its needs and problems his life study. This recommendation was ignored until 1909, when the fur seal service was transferred to the Bureau of Fisheries. The position of naturalist to the herd was then created, but through the death, resignation, and serious illness respectively of the first three appointees, the position, at the close of the season of 1913, was still vacant and systematic work yet to be begun. In October of that year, the present Secretary of Commerce abolished the position of naturalist, on grounds of economy, leaving the herd again to its own devices, except for such desultory attention as the government agents may be able to give it.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members, MRS. C. N. DIETZ and MESSRS. ALFRED I. DUPONT and WM. M. KERR.

Annual Members, MRS. M. G. JUSTIN ASHTON, MRS. GEORGE H. MAYO, MRS. STELLA STERN, MISS VALENTINE L. CHANDOR, and MESSRS. S. A. GOODMAN and ROBYN MACFADDEN.

THE experiment of growing Mandan maize in the tulip bed in front of the American Museum during the past summer was successful, although strictly test conditions were not followed in its culture. Many different colors were sown, and as the stalks were so close together that the pollen of the tassels intermingled, some of the new crop has produced ears in which all these colors are combined. Other ears are entirely red, or blue, or black, or white as the case may be. The kernels are larger than the seed planted, showing that if the Mandan maize were grown in this part of the country it would develop a high food value. Owing to investigations made by the American Museum under the direction of Dr. G. L. Wilson, by which the method of cultivating this hardy variety was learned, millions of bushels of corn are now raised in the mountainous regions of the West where previously none was grown. Samples of the crop grown in the tulip bed are displayed in a case in the foyer of the Museum.

At a meeting of the board of trustees, on September 19, Mr. James M. B. Hard was elected to succeed to the patronship of his father, the late Mr. Anson Wales Hard, who was a trustee and associate benefactor of the American Museum.

DR. THOMAS G. HULL, of the department of public health, has been summoned to Washington to act as Chief of the Division of Exhibits of the United States Food Administration. His duties will consist mainly in preparing plans for food exhibits and in furnishing information to various organizations that wish to install such exhibits.

The Origin and Evolution of Life, on the Theory of Action, Reaction, and Interaction
500

of Energy, by Henry Fairfield Osborn, which has just come from the press of Charles Scribner's Sons, puts forward a new theory or "energy concept" as a basis for the study of the causes of evolution. The book represents the Hale Lectures delivered by Professor Osborn at Washington before the National Academy of Sciences, in April, 1916. It will be reviewed in a later issue of the JOURNAL.

At the meeting of the executive committee of the board of trustees of the Museum held on October 17, Mr. W. Elmer Ekblaw of the University of Illinois was appointed research associate in geology for the years 1917 and 1918, this in recognition of his admirable record and services on the Crocker Land Expedition during the years 1913 to 1917.

A RECEPTION to the returned members of the Crocker Land Expedition, together with the first private view of the collections made by the expedition in the Arctic, was held at the Museum on the evening of October 10. The attendance numbered about four hundred. With the exception of one, all of the members of the scientific staff of the expedition were present. The exhibit includes the tent and the camp fittings used by Mr. MacMillan in the Arctic, various sledges and kayaks, the eggs of the strange bird known as the knot, Eskimo clothing of the eastern Arctic type, skins of rare animals, and many archaeological specimens. A series of drawings by the Eskimo attracted considerable attention. The large collections brought back by the Crocker Land Expedition will remain on display in the Philippine hall for a week or more, thus enabling the public to examine them even before they have been installed formally in the Museum.

MANY applications have been received from educational institutions to borrow the food exhibit which was displayed for several months in the foyer of the American Museum. The exhibit has been transferred for the present to the Washington Irving High School, where it is now on view. This school is ideally situated for such an exhibit, being accessible to many thousands of people in the community as well as to the nine thousand girls who attend the sessions.

DR. JUAN B. AMBROSETTI, a distinguished student and scientist of Argentina, whose death occurred in May of this year, was one of the most prolific investigators and writers in America. The literature of American archaeology has been greatly enriched by the published results of the researches of this explorer, who was generally regarded as the highest authority on the archaeology of Argentina. Dr. Ambrosetti was director of the Ethnological Museum of the Faculty of Philosophy and Letters in the National University of Argentina, and his reports, numbering about seventy-five, are proof of the energetic character of his work, besides serving to enhance the standing of Argentina and South America in the scientific world. His position as an authority on archaeological matters brought him into touch with the leading scientists of the world, while articles dealing with his investigations appeared in nearly every journal of recognized scientific standing in Argentina. Among the magazines to which he has contributed are

the *Bulletin of the Argentine Geographic Institute*; *Annals of the Argentine Scientific Society*; *Annals of the National Museum of Buenos Aires*; *Review of the La Plata Museum*; *Bulletin of the National Academy of Sciences of Cordoba*; *Review of the Buenos Aires Zoological Garden*; and the *Review of Law, History, and Letters*. Dr. Ambrosetti was named by the Argentine government as one of its official delegates to the Second Pan American Scientific Congress, which met in Washington, D. C., in December, 1915. He was also the accredited delegate from the following learned societies and educational institutions: Faculty of Philosophy and Literature of the National University of Buenos Aires; Faculty of Agronomy and Veterinary Medicine of the National University of

Buenos Aires; Museum of the University of La Plata; National University of Cordoba; Museum of Natural History of Buenos Aires; Board of American History and Numismatics; Argentine Scientific Society; and the Argentine Geographical Institute. He was president of the first session of the congress and was an honorary vice president of the Congress of Americanists.

On the afternoon of September 29 a large and informal gathering of friends surprised



The late Dr. Juan B. Ambrosetti, of Argentina

Professor Henry Fairfield Osborn at his home at Garrison-on-Hudson in honor of his sixtieth birthday. The visit had originally been planned for August 8, his birthday, but was necessarily deferred until September 29, which chanced to be also the thirty-sixth anniversary of his marriage with Mrs. Osborn. The Museum was represented by Mr. Madison Grant of the board of trustees, by the members of the scientific staff and their wives, by the members of the department of vertebrate palaeontology

and of the administrative and technical staffs and their wives. The New York Zoological Park and the New York Aquarium, Columbia University and Princeton University were also represented. The weather was favorable so that the arrangements for luncheon on the lawn were enjoyably carried out. After the luncheon Professor Edmund B. Wilson of Columbia read congratulatory messages from Colonel Theodore Roosevelt, President Nicholas Murray Butler, and Mayor Mitchel, and presided at the addresses, the speakers including Mr. Madison Grant, Professor McClure of Princeton, Mr. William Church Osborn, Professor Bashford Dean, and Dr. Frank M. Chapman. Dr. F. A. Lucas gave a discourse on "Birthdays," after which he presented to Professor Osborn

an illuminated Message of Congratulation bearing forty-six signatures. The text of this message and the signatures were as follows:

TO

HENRY FAIRFIELD OSBORN

Your friends, who are bound to you by many years of treasured association, bring this Message of Congratulation upon your Sixtieth Birthday.

We have followed with increasing admiration the progress of your labors during the past forty years in an ever widening field of science. We are proud of the splendid record of your achievements: admirable researches accomplished and in progress, great institutions of science and education founded and fostered, high scientific ideals nobly illustrated and practised.

May the coming years further expand the orbit of your influence. May your spirit of high enthusiasm, thoroughness and unwearying industry, sustained by the cordial sympathy and coöperation which you have always shown toward others, become more and more characteristic of American Science.

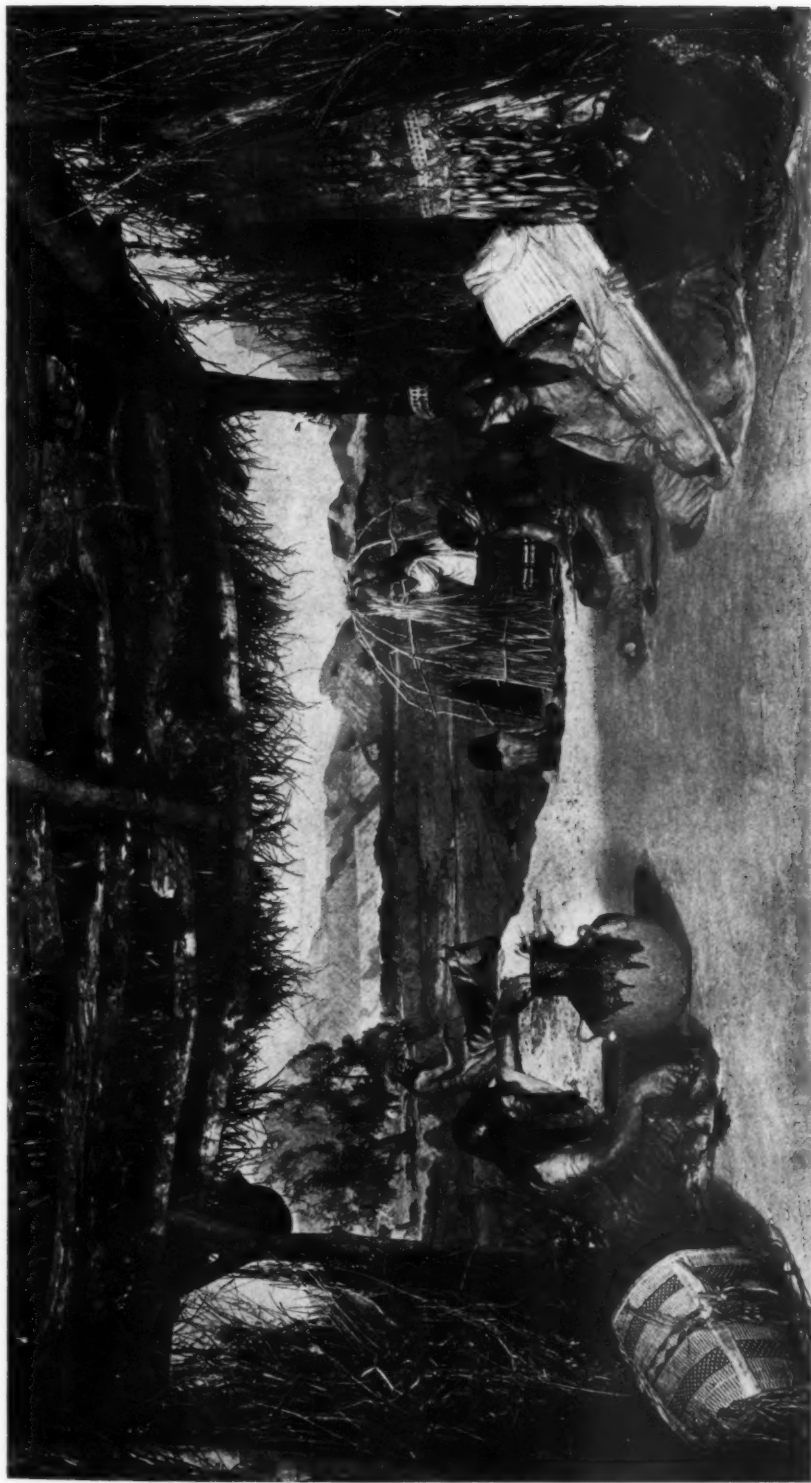
August 8, 1917.

J. A. ALLEN	EDMUND B. WILSON
L. P. GRATACAP	WM. H. CARPENTER
GEORGE F. KUNZ	BASHFORD DEAN
E. O. HOVEY	HENRY E. CRAMPTON
FRANK M. CHAPMAN	T. H. MORGAN
JONATHAN DWIGHT	GARY N. CALKINS
ROY W. MINER	J. HOWARD MCGREGOR
W. D. MATTHEW	W. B. SCOTT
WALTER GRANGER	CHAS. W. MEAD
BARNUM BROWN	CHESTER A. REEDS
A. HERMANN	JOHN TREADWELL NICHOLS
WILLIAM K. GREGORY	CLEVELAND H. DODGE
FREDERIC A. LUCAS	MADISON GRANT
THEODORE ROOSEVELT	PERCY R. PYNE
N. L. BRITTON	W. T. HORNADAY
GEO. H. SHERWOOD	CHAS. H. TOWNSEND
R. W. TOWER	C. W. BEEBE
MARY C. DICKERSON	RAYMOND L. DITMARS
PLINY EARLE GODDARD	S. H. CHUBB
CLARK WISSLER	ALBERT THOMSON
FRANK E. LUTZ	E. S. CHRISTMAN
FRED H. SMYTH	A. E. ANDERSON
GEO. N. PINDAR	H. LANG

THE Apache Indian life group, which was opened in May, marks another important step in the American Museum's study of Indian life in its native environment. The scene portrays the semidesert landscape in the valley of the San Carlos River, Arizona. Indians are shown engaged in weapon and basket making and in housebuilding. The background, a canvas eleven feet high by

sixty-five feet long, was painted by Mr. Howard McCormick from sketches made by him in the Apache country; he also planned the details of the group, and superintended the arrangement of the lighting. The various figures were modeled and colored by Mahonri Young from studies in the field. The Apaches are nomadic tribes of the Southwest, inhabiting southern Arizona and New Mexico. The name has become widely known through certain divisions of the tribe who carried on warfare against the Mexican settlers for many years, until restrained by the United States government and placed on reservations. All of the Apaches west of the Rio Grande make houses having pole frames covered with a thatch of weeds and grass. The poles are set in the ground, and the tops bent over and lashed together, forming a dome-shaped structure, as shown in the group. The Apaches cultivate corn and beans to some extent. They often obtain large crops of wild piñon nuts. The bean-like pods of the mesquite are eaten when green and the dry seeds ground into flour. The amole has a banana-shaped fruit which is cooked in the ashes and afterward dried. The agave, a century plant, also furnishes nutritious food, and many species of cacti have edible fruit. Besides these, berries, seeds of grasses and sunflowers, nuts and bulbs, add considerably to the natural food supply. The Jicarilla Apaches make what pottery is required for household purposes. Their ware is undecorated, except for ridges or points modeled in low relief. Pine bark is used in the firing of the vessels, giving them a lusterless black surface, and when cool they are coated with piñon gum to make them more durable. It is in their basketry that the Apaches display greatest artistic skill. Willow and sumach are used, single twigs for the foundation and split sap portions for the sewing material. Designs are geometrical and the colors almost exclusively black and white. Basketry water jars are coated inside with piñon pitch to make them water tight.

IN early summer Dr. C. R. Eastman left on a collecting trip to South America for the purpose of making additions to the series of fossil and recent fishes from that country, and of carrying out some of the plans formed by Dr. Frank M. Chapman in the direction of increased friendly relations and coöperation with scientific institutions in



THE APACHE INDIAN GROUP IN THE AMERICAN MUSEUM

This group was formally opened in the early summer of 1917. It represents the Apache Indian in his native environment engaged in the ordinary pursuits of his daily life. The background depicts the typical Arizona landscape, as seen in the valley of the San Carlos River, while the brush shelter under which the women are working is the usual summer home of these Indians. The background of the group is a canvas eleven feet high and sixty-five feet long painted by Mr. Howard McCormick, who also planned the group as a whole and supervised the work on it. The figures were modeled and colored by Mr. Mahonri Young

Central and South America. Among the institutions Dr. Eastman expects to visit are the following: Museu Nacional and Jardim Zoológico, Rio de Janeiro, Brazil; Museu Paulista, Sao Paulo, Brazil; Universidad Nacional, Asunción, Paraguay; Museo Nacional, Montevideo, Uruguay; and Museo Nacional de Historia Natural, Buenos Aires, Argentina. Dr. J. D. Haseman and other collectors have sent back to the Carnegie Museum of Pittsburgh sufficient fresh-water material from the regions that Dr. Eastman will visit to demonstrate the presence there of diagnostic forms, but they do not seem to have exhausted the possibilities, and it is hoped that interesting unknown species will be brought to light. As regards marine fishes, those of northern South America belong to the well-known West Indian fauna; the fishes of the east coast farther south, on the other hand, are comparatively little known, and a collection of them should not only contain many interesting species, but also furnish desirable data on the distribution of marine fishes in general. The work already done on fossil fishes in Brazil has been carried on by Agassiz, Woodward, and Jordan. Dr. Eastman expects to make collections of Ganoids from the Cretaceous of the state of Ceará, and Clupeoids from the east coast of Brazil.

MR. JAMES L. CLARK, who is coöperating with Mr. Carl E. Akeley in the work of mounting the large African mammals obtained for the American Museum by the Congo Expedition, returned during the summer from an expedition to western Alberta. This trip was made for the purpose of studying the grizzly, black, and brown bears so abundant in that section, and the early season was chosen because at that time one is more likely to find bears feeding on the young grass, and also because their coats are in their fullest and finest condition. The anatomy of the animal was studied from slain specimens, and characteristic attitudes and habits were watched through field glasses. Mr. Clark's immediate work is the mounting of the third white rhino for the African hall, one adult specimen and a calf already being finished. This animal, with its huge bulk and headlong method of attack, reminds one of nothing so much as that invention of modern warfare, the British "tank." Further work of interest for the Museum is the remounting of the Atlantic walrus group, the old and

faulty methods used having caused these valuable specimens to deteriorate to a point where they would shortly be useless. The method now used is the one evolved by Mr. Akeley, which, says Mr. Clark, "revolutionizes the mounting of pachyderms."

RECENTLY thirty-five girls from one of the largest of New York's department stores visited the Museum to study the various techniques in weaving and in decorating textiles, and especially to see the beautiful cloth of the prehistoric Peruvians, and the primitive looms in the South American gallery. It is the intention of this firm that other parties shall follow until all their employees in the textile departments have taken advantage of the educational facilities of the Museum in this line.

THE annual competitive exhibition of the Aquarium Society was held in the west assembly room of the American Museum from October 12 to 14. Of especial interest were the different species of *Barbus* shown this year, one from Japan with prettily mottled back-fin being notable. This genus comprises many closely related small fishes of the carp family, most numerous in southern Asia. Their small size, activity, beautiful colors, and distinguished markings render them attractive for aquarium culture.

THE annual exhibit of the New York Horticultural Society will be held in the foyer and adjacent halls of the American Museum from November 9 to 11. An unusually fine display is planned, which will include chrysanthemums of great size and beauty, unique orchids, and some new varieties of roses. A private view of the exhibit will be given on the evening of November 8.

THE first lecture of the children's course, which was given on the afternoon of October 15, was the occasion of the formal opening of the newly reconstructed and redecorated auditorium of the American Museum. President Henry Fairfield Osborn extended a hearty welcome to the large number of school children present, and Mr. George H. Sherwood, curator of the department of education, outlined in a brief address the features of the course. The lecture of the afternoon, on "Mexico and Central America," was delivered by Mr. Charles H. Rogers of the department of ornithology.